INFORMATION TECHNOLOGY IN CONSTRUCTION OPERATIONS: SOCIAL MEDIA A VIABLE ALTERNATIVE OF INFORMATION MANAGEMENT FOR A SMALL CONSTRUCTION BUSINESS

A Thesis

by

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ABSTRACT

This thesis addresses the construction industry with strict concern towards small construction related establishments in America. The author expands on the subject of an affordable Information-Technology (IT) solution that is viable in handling the information management during construction related practices. In this study social media becomes the proposed IT solution to the industry because of the functions it enables, and as well the affordability. Proposing social media leads the researcher to analyze if managing information is a technically feasible practice via social media.

In order to understand if social media is technically feasible in handling construction operations' information management, qualitative analysis and case studies using the most appropriate social media platform to perform construction activities have been carried out. The most appropriate social media platform was chosen by cross analyzing their functional capabilities. Then case studies were achieved through the chosen social media Google+. These case studies allowed the researcher to discover similar functions in social media that could execute construction operations' information management activities such as sharing documents, creating schedules and monitoring work – also constraints of social media such as generating word documents and spreadsheets are highlighted.

The purpose of this thesis is so to propose an affordable information management alternative for use within the construction industry. It is imperative that every construction professional have the ability to effectively manage information throughout the duration of their business. And if Project Management Information Systems (PMIS) software – and software alike - remains too costly then a practical solution could rely in using social media for smaller construction related businesses.

It is with this purpose that guides the researcher to understand if applying social media to information management in the construction industry is technically feasible. Social media has made it easier to create, capture, manage and share information among several users and groups. The aim of this research is to study similar capabilities in social media that can effectively perform construction activities. After determining what activities can and cannot be completed, several case studies – using

social media to carry out virtual construction activities – will be used to validate study. The technical successes and constraints are summarized in the chapter IV conclusion of this thesis.

DEDICATION

To my Mother, Marlin Butler & to my Father, Norman Butler, whose living memory will always be a blessing.

ACKNOWLEDGMENTS

My mother, Marlin Butler, who has always been supportive and raised me to obtain value in everything I do. To all my mentors – My Church Family, Young Scholars Program, Omega Psi Phi Inc. and every single one of my professors/teachers/educators – these people believe in me and taught me friendship, scholarship and perseverance. And last my chair, Boong Yeol Ryoo, for working with me patiently and giving me advices beyond academics.

NOMENCLATURE

IT	Information-Technology
ICT	Information and Communication Technology
PMIS	Project Management Information Systems
WBS	Work Breakdown Structure
TV	Television
PM	Project Manager
BIM	Building Information Modeling
3D	Three-Dimensional
CEO	Chief Executive Officer
VPO	Vice President of Operations
GB	Gigabyte
VS	Versus

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

CHAPTER I
INTRODUCTION,
PROBLEM AND PURPOSE

Introduction

Professional businesses in the construction industry should begin to adopt social media because it is a low-costing platform with the potential to positively impact the way we manage information during construction operations. Some of the latest technologies – with immediate relation to social media – called information and communication technology (ICT) has been recognized as a significant organizational resource. However, usage of ICT in most construction companies have been described as relatively limited and ineffective compared to other sectors in most economies (Sekou, 2014). Adoption of new IT burdens a business with overhead expenses. Software that remains too costly may be a cause for its limited use in an industry where the majority of construction related establishments are classified as a small business with limited capital to afford the latest innovative information management technology.

Recently, social media platforms such as Facebook, Google+ and others have made it easier than ever for people to generate, capture, manage and share information, at the price of an internet bill. Popularity has increased in social media over the past several years, but this has been for personal use - it should be little surprise that businesses begin to find ways to implement these social tools in their strategy. Some research has been conducted on the use of social tools and its role in managing information within an organization.

The most promising social tools are those platforms which offer rich social experience where information exchange is happening in an open and everyday manner (Dave & Koskela, 2009). However, contemporary technology being used - only by a small percentage of the construction industry - to ensure mentioned benefits are costly

IT platforms such as Project Management Information Systems (PMIS) Prolog Manager and ICT Tutor2u . Construction firms without enough resources to purchase mentioned software need an alternative. Pursuing a more affordable alternative in

information management through social media(s) leads the researcher in this study. This problem has been designed to stimulate groundbreaking investigations of the technical feasibility between applying social media towards construction operations' information management.

Problem

Enabling an affordable information-technology (IT) solution that is viable for information management of construction operations' procedures.

Purpose(s)

The objective of this study is to propose a more affordable information management alternative for users during construction operation. The user groups of construction operations are many, meaning there should to be efficient transfer of information available in order to succeed in presenting a client with a good project (e.g. of information pricing change, shipments, owner alerts). It is imperative to every construction professional that they effectively manage information throughout the duration of their business. Social media is an inexpensive tool that can potentially help the management of information in the construction industry that anyone in business can afford.

It is with this purpose that the researcher will analyze the technical feasibility in applying social media-IT towards construction operations' information management. In doing so, this study will examine how the applications of social media platforms such as Facebook, Google+, Twitter, Instagram and others might perform construction operations' procedures such as: contract solicitation, arranging deliveries, verifying invoices and work supervision. Lately, there has been few strides to learn the use of social tools for business purposes. It is purposeful in most cases for advertising - but there has also been other applications for the tool, such as customer service, sales support, and communications. However, the scope of this study is limited to using social media to facilitate construction operation procedures only.

Research Objectives

The research objectives allow the researcher to set goals for the study. These goals will lead the researcher in effectively planning a course of activities toward enabling an affordable IT that is viable to information management. The main objectives of this study are:

1. Proposing a new information management framework for construction operations that enables inexpensive IT.
2. Discover similar capabilities in social media that can perform construction operations' procedures.
3. Prove- through simulation(s) - that social media can perform construction operations' procedures.
4. Propose a social media prototype that will facilitate and manage construction project data.

Methodology

The intention of this study is to understand the feasibility of applying social media towards performing construction operations' procedures. Social media has made it easier to capture, manage and share information among several user groups. Throughout the duration of construction company operations many user groups are responsible for the flow of information and this study exercises to find an effective social tool to manage that flow of information. The first cornerstone of the research is to discover similar capabilities in social media that can perform construction operations' procedures. After determining social media that are applicable in performing construction operations' procedures, then the researcher will propose the platform(s) that performs the best. The definition of best performance goes to the social media platform(s) that are able manage most of the important information. Using the best

performing social media, simulate virtual operational procedures and validate some feasibility of social-media-information-management.

Research Plan

Below is the research plan, displayed in Figure 1.1. The research plan has been divided into 6 steps. In step (1) the researcher proposes a study of the contemporary uses of social media within the construction industry. This allows understanding of how the construction industry has begun to leverage social media to its advantage. Step (2) begins the approach toward later case studies by selecting a focus which defines some limitations. Step (3) and (4) is another approach toward later case studies by researching social media functions and proposing a single (most applicable) platform to carry out research. Step (5) begins case study: using applicable social media to simulate virtual construction operational procedures. These case studies will give validity to social media being able to manage construction operational activities vs traditional means. Screenshots will be taken to help illustrate approaches to study and the constraints of social media handling construction activities will be recognized. After validating that a few construction operations can be handled via social media step (6) will begin a re-design of the social media site to facilitate and host a user to manage all construction operations information management.

Step	Method	Data	Deliverable
1. Research contemporary usage of social media within the construction industry	- Discover how the construction industry is currently using the capabilities/functions of social media - Create a table that highlights the usage of the usage of social media within	- Articles - Journals - Online sources	- Understanding how the construction industry has begun to leverage social media to its advantage
2. Decide construction operations' user groups as well as the procedures and processes as a focus of researcher's plan	- Selectively choose user groups of construction operations as a focus - Selectively choose procedures and processes of *selected user groups as a focus	- Construction Operations' Procedure Manual of a contractor	- Defining a focus of the research plan
3. Research existing social media's capabilities in order to discover the construction operations' procedures that can be performed	- Select contemporary social media platforms that are successful by means of user satisfaction -Discover capabilities in social media that can perform construction operations' procedures - Create a table/spreadsheet that highlights social media's performance capabilities vs. construction operations' procedures and processes	- Shortlisted contemporary social media - Software that can create Spreadsheets (ex. Excel)	- Enables the researcher's knowledge about what construction operations' procedures and processes can be facilitated through social media
4. Propose one social media platform that is applicable in facilitating construction operations' procedures and processes	- Compare performance capabilities of *selected social media - Select one social media platform that will perform construction operations' procedures and processes above the rest	- A spreadsheet that highlights social media's facilitation constraints vs. construction operations' procedures and processes	- One contemporary social media platform that performs well (above the rest) in facilitating construction operations procedures and processes

Figure 1.1 Research Plan

5. Case study: Use applicable social media platform to simulate virtual construction operations' procedures and processes.	- Simulate construction operations tasks through an existing and applicable social media site - Screenshots will be taken of virtual operation tasks via PC	- Construction Operations' Procedure Manual of a contractor - Social media sites that can simulate operational tasks (ex. of highly capable social media platforms: Google+, Facebook and Twitter)	- Validation: Construction operations' procedures and processes being managed through social media - Screenshots - vs Traditional (time etc) - Proof that operational tasks can be facilitated and managed through social media - Will help gather requirements for the social media prototype
6. Re-design of an existing social media platform that will facilitate all procedures and processes for a contractor	- Finalize the requirements and constraints that have been gathered - Find open-sourced software that is most suitable for handling social media constraints - Propose a redesign of current social media platform - Attempt to integrate redesigned social media platform with open-sourced software - If attempt is successful, test and make necessary validations to our newly created platform	-Construction Operations' Procedure Manual of a contractor - Software will be chosen based on the requirements to be met as well as the languages chosen to carry out this task	- A re-design of Social media that is meant to facilitate and manage construction operations - Screenshots

Figure 1.1 Continued

Benefits & Beneficiaries

This section states the researcher's expectations and benefits as a result of the research, these are:

1. The research will discover some construction operations' procedures that can be performed via social media platform(s) with the addition of realizing what cannot

be performed. The beneficiaries of this result are all users of construction related practices (ex. builder, supplier, owner, future clientele and etc.)

2. A single social media platform will be identified above others as being the most technically feasible platform to carry out construction operations' procedures. Beneficiaries of this result remain the same.
3. Pure validation of social media carrying out construction operations' procedures and methods. Beneficiaries of this result are the same.
4. Constraints of social media being able to perform information management during construction operations will be highlighted.

Delimitations

The review of delimitations are explanations of boundaries set by the researcher for this study, and these are:

1. Software components of popular social media platforms such as Facebook, Google+, Instagram and Twitter will be analyzed during the study of applicable social media for information management.
2. Only the operations of a small contractor's WBS will be taken into consideration. To be more specific small contracting business with <15 people on staff.
3. The latter case studies during research will be limited to the operational tasks of field supervisions. This allows the researcher to cover a sample portion of the entire operations of a small contractor.

Limitations

The review of limitations described are influences that the researcher cannot control, these are:

1. Privacy and protection of information. Protection and Privacy of information is controlled by existing social media conditions.

2. Social media at its infancy. Social media software will continue to evolve in itself and also become integrated into existing information systems. Meaning later studies, if repeated exactly as this researcher's plans and approaches, can confirm different results.

Assumptions

The review of assumptions can be considered as beliefs a/o biases of the researcher that could possibly be assumed in the study, these are:

1. Social media is one of the most commonly used forms of Information Communication Technology at the time of writing this paper.

CHAPTER II
LITERATURE REVIEW

The literature review will report 2 areas of assessed information that relate to the study of enabling affordable IT that facilitates information management during construction operations. These areas are: (1) Current Information and Communication management in Construction Operations, (2) Usage of Social Media.

Information Management in Construction Operations

High performing construction operations are facilitated through implementation of written PM procedure manuals and electronically by PMIS systems. The construction industry has a relatively small number of general contractors that use PM procedures to describe how they manage building construction projects. For those who do actively use procedure manuals are at an advantage because it assist in developing a management plan and allows examination on past performance for improvement. For the other majority that are not assisted by PM procedures for construction, they must often rely on their past experience and individual knowledge which leads to the end result of insufficient procedures for management tasks during every project. (Ryoo, 2013)

If construction operations task are set through PM manuals then measures can be developed in order to generate feedback from key issues. Gaining feedback on latter issues during construction leads to control of construction quality, thus improving building quality and competitive advantage (Liu, Zhong, Cui, Zhong & Wei, 2014). Those construction firms that do not have a standard for managing information and communicating while on a project are led by the direction of a site manager and his past experience and knowledge. More traditional practices that have been proven costly are exercised under this type of direction such as excess site visits for various reasons and excess paper work (vs. file sharing) - leaving this large group of construction professionals less competitive, maybe lacking their best potential of quality and most important a less profitable business.

Usage of Social Media

According to *Pew Internet & American Life Project*, as of September 2009, 73% of online American teens ages 12 to 17 used an online social media website, a statistic that has continued to climb upwards from 55% in November 2006 and 65% in February 2008 (Lenhart, Purcell, Smith & Zickuhr, 2010). This indicates that the future leaders of the construction industry continue to be avid users of social media websites. Favored social media sites come in variety of layouts because of its scope and functionality. A recent study by *Econsultancy.com* explains that a good percentage of businesses are using social media websites to their advantage (Econsultant, 2010). Displayed below is Figure 2.1, showing the percentage of businesses using social media.

Social Media Website	% of businesses using social media
Facebook	85%
Twitter	77%
LinkedIn	58%
Youtube	49%

Figure 2.1 Businesses Using Social Media (econsultant, 2010)

The audience of these social media sites might be aimed toward general masses, focused professional networks or media sharing sites. According to *Business Horizons* the most popular social media sites are displayed in Figure 2.2.

Category	Website	Individual Users
General masses	Facebook	1.32 billion*
General masses	Google+	540 million*
General masses	Twitter	270 million*
Professional networks	LinkedIn	300 million*
Media Sharing	Youtube	1 billion*
Media Sharing	Instagram	400 million*

Figure 2.2 Popular Social Media by Category as of 2013

The large variety of social networks is a premiere example of social media being used in various ways to manage, share, control, and view information.

Companies have begun leveraging social media in their efforts to stay competitive. Maybe the most frequently used features have been advertising - but there have been other application of social media, including customer service, sales support, communications and many others (Mangold & Faulds, 2009). A case study on Best Buy and its engagement towards social media was done. Like other companies using Facebook, it allows the business to interact with their customers. Best Buy takes it a step further and solicits information from its customer: Figure 2.3 IDEAX provides customers a way to recommend improvements and Figure 2.4 TwelpForce is a twitter-based outlet that provides customer inquiries.

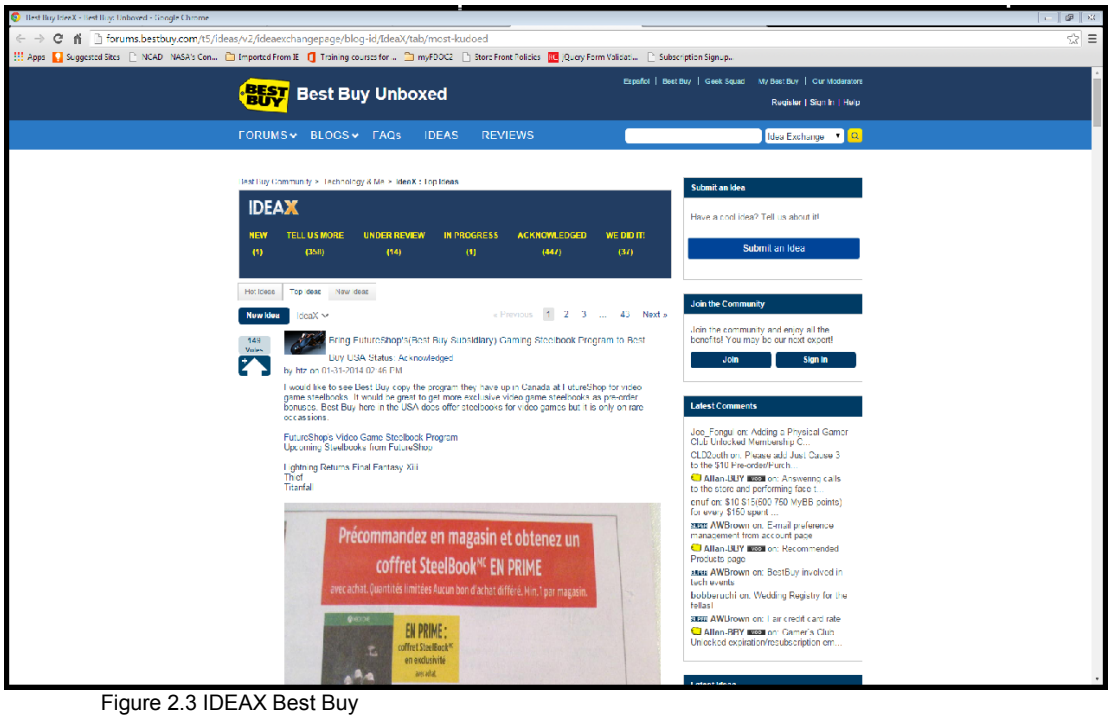


Figure 2.3 IDEAX Best Buy

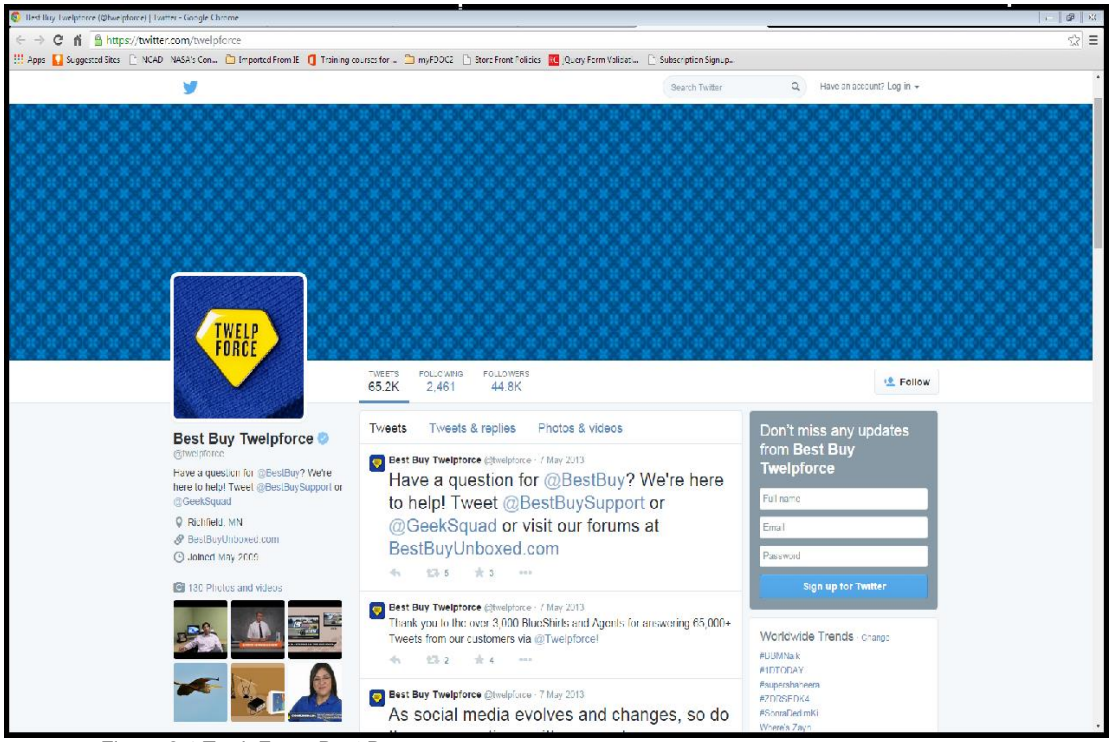


Figure 2.4 TwelpForce Best Buy

Users can generate information by using social media, and that information can be gathered and shared across any supply chain (O'leary, 2011). This means that information is not held from anyone - In doing so, social media should eliminate numerous overlaps of the same information. Social media allows a two-way interaction with an audience, beyond any specific recipients - this form of communication is defined as many-to-many, where messages are being broadcasted to a wider audience who can then participate and exchange information.

Social media should not be subjected for use in communications and information sharing alone, social media allows individuals to perceive aspects of their social environment when it is convenient to the user. This means construction operations users are allowed to be attentive to what is happening along the project by the second (Petras, Eigenbrodt & Spier, 2011). A technical component of Facebook allows a profile administrator to upload media that is linked to the time of upload. Now anyone viewing this will see sequence of media by date and time.

Conclusion of Literature Review

This literature review was meant to outline the (1) importance of information management during construction operations and (2) the uses of social media during operational procedures - including evidence-based case studies. After reviewing the importance of information management during construction operation it can be understood that it is imperative to the success of the builder. This paper is intended to enable an affordable alternative for information management in the construction industry so that every construction professional has the potential to deliver projects of good quality. Taking a look at the contemporary uses of social media it is apparent that this IT has the potential for maintaining information management throughout the duration of construction operations. However, it is yet known which operational procedures can be facilitated through implementation of social media. This problem has been designed to stimulate groundbreaking investigations of the technical feasibility between applying social media towards construction operations' information management.

CHAPTER III
FUNDAMENTAL KNOWLEDGE

Construction Operations (Process)

Construction operations is a repetitive variable in the construction process and the variables surrounding it changes the outcome of implementation. In order to better understand how the construction operations process takes part, what needs to be understood foremost are the levels of construction that takes place around it. Then the construction operations process will be defined in a simpler manner. This section will cover these categories: (a) hierarchy of construction and (b) the nature of construction operations (c) construction operations' users [and figures]. These categories will help the reader understand further into construction operations and give significance on how/why it can see improvement in various areas.

The Hierarchy of Construction

Understanding construction and its hierarchy levels is a stepping stone to learning the meaning of construction operations - or said another way - the operations within construction. In general, the construction industry is made up of 5 different parts, those are: commercial, residential, heavy civil, industrial and environmental. And although the industry is fragmented, the entire construction process holds the same responsibilities and completes similar - if not the same - processes as every other sector of the industry (Segerstedt & Olofsson, 2010). The only thing that separates the construction process in one sector from another is the information per construction project. This information is subject to the types of design, equipment, materials, subcontractors and geography. This can mean a long list of organizational (hierarchy) structures within construction management.

This thinking of hierarchy is derived from the fact that construction is traditionally project based so decisions that are carried out at levels above the project are completely related to company management considerations. While decisions that are project related are grouped to operational considerations (e.g., determining site

strategies) as well as the utilization of resources to multiple production processes and work tasks selected to realize the final product. (Halpin & Riggs, 1992)

But specifically, four levels of hierarchy can be identified in order to display organization within construction. The four levels are defined as follows:

1. Organizational Level. This level is concerned with the legal activity and the business structure of a firm, multiple functions of management, plus the interaction that comes from head office and field managers performing these functions.
2. Project Level (and Activity). The vocab related to this level is controlled by the breakdown of the project for the function of time and cost control (e.g., project cost accounting). Current cost, time and resource status.
3. Operation (and Process) Level. This level exercises technology and details of how construction should be performed. Its focus pertains to work at the field level. Normally a construction operation is so complex that it has multiple processes, each with its own technology and work task assignments.
4. Task Level. This level is a matter of the identification and assignment of work to field assistance.

The Nature of Construction Operations

After understanding the basic construction hierarchy structure, it is now clear that the organizational, project and activity levels are project and top management priorities, while the operation, process, and work tasks levels have a work focus (Halphin & Riggs, 1992). At these separate levels decisions are being made. At the organizational level, decisions made about what projects to pursue and hiring personnel is the focus. At the project level, decisions related to estimates and scheduling must be considered. However, the project must constructed. Physical material such as brick, wall board, wood, steel and a wide range of other materials must be erected, placed and installed to achieve a complete building. This is the production level in construction - this is where the nature of construction operations is implicated.

The construction operations are joined immediate to the means of achieving a final product and can be repetitive in nature. Hence, it is another expression for and is joined to a construction method - and as well, having complete connection to the final product with the exception of it not being tangible (Windapo, 2013).

Construction Operation Users

Illustrated in Information Management in a Contractor - book by Norman Fisher and Shen Li Yin - users within construction operations can influence other users through the use of drivers (ex. tender / contract and specification clauses). Figure 3.1 gives a context diagram of the players involved in construction company operations (Fisher & Yin, 1992): client, head office, design team, suppliers, sub-contractors, site and plant-hire companies.

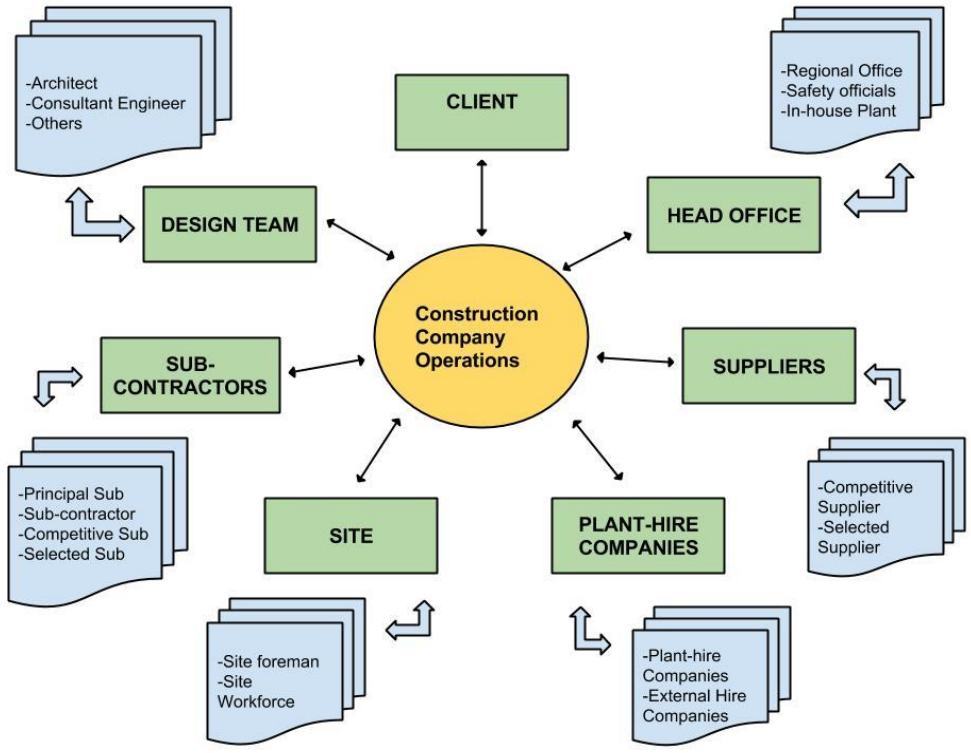


Figure 3.1 Construction Operations

Client - All public and private regular and irregular customers of the industry. The person(s) requiring the project and paying for it (Fisher, 1992).

1. Head office - This user is composed of the following sub-users: regional office, safety officers and in-house plant department (Fisher, 1992).
2. Design team - Includes: architect, consultant engineers, chartered quantity surveyors and any ‘project management’ consultants (Fisher, 1992).
3. Sub-contractors - These are nominated sub-contractors, including ‘specialty trade’ contractors (including the main contractor’s own domestic subcontractors). And this user has the following sub-users including: principal sub-contractor, sub-contractor, competitive sub-contractors and selected sub-contractors (Fisher, 1992).
4. Suppliers - This user has the following sub-users: competitive supplier and selected supplier (Fisher, 1992).
5. Site - This user has the following sub-users: site foreman, site workforce (Fisher, 1992).
6. Plant-hire companies - This user has the following sub-users: plant-hire companies, selected external hire company (Fisher, 1992).

Social Media

This section will explore some background of social media to better understand its features and implication potential. These categories are featured: (a) Introduction to Social Media (b) distinction of social media and popular platforms. These categories will help the reader understand further into social media and help give significance on how/why social media can improve construction operations.

Introduction to Social Media

Social media can be defined as the interaction among people that are allowed to create, send or exchange information, ideas and picture/videos over virtual communities and networks (Ahlqvist, Back, Halonen & Heinonen, 2008). It is also widely recognized by Andreas Kaplan as “a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and

exchange of user-generated content."(Kaplan & Haenlein, 2009) To take things a step further, social media is dependent upon mobile and web-based technologies to create the goal of a highly interactive platform that can be accessed virtually from any location. Due to the list of tools offered and the continuous pace of developing new features, policies and applications, it is challenging to pin-point the qualities of social media based on its features alone (Petras, 2011). Social media platforms introduces users to a greater social experience where information can be managed and exchanged between organizations, communities, and individuals in an instant. Social media differs in many ways that allow users to ultimately control portions of the information that cannot be done otherwise, while using traditional media.

Distinction of Social Media from Other Media

A common denominator amongst social media is the blend of technology and social interaction in order to create value (Chui & Manyika, 2012). Social media are very different from industrial/traditional media such as periodicals, magazines, movies and tv as they are comparatively low in cost and have high accessibility. Figure 3.2 describes the subtle differences between social media and traditional media.

Properties	Industrial/Traditional Media	Social Media
Quality	- Controlled by a publisher - Range of quality is substantial to division/market	- High variance of quality
Reach	- Reaches global audience - News is controlled by few	- Reaches global audience - News is controlled by many
Accessibility	- Usually, means of production are owned by the government a/o private owners	- General to the public at little or no cost
Usability	- Production requires professional skills and training	- Anyone with access can learn to operate
Immediacy	- Time lag between communications may seem long (hours, days, weeks, months e.g. magazines)	- Instantaneous
Permanence	- Once created, no alterations	- Can be altered instantly by editing or commenting

Figure 3.2 Social Media vs Traditional Media

CHAPTER IV
APPROACH, RESEARCH AND CONCLUSIONS

Having read the purpose of this study, literature review – with added fundamental knowledge of construction operations and social media implications – we now turn to the approach, research and results. Under subheading (1) *work breakdown structure (WBS)* discusses the umbrella of construction operations' processes that are referenced in this study. Next, (2) *finalizing operations for case study* gives detail about the operational activities that will be simulated in later case studies. (3) *Shortlisted social media* informs the reader on approaches toward selecting a social media platform to carry out later simulations. (4) *Proposed social media* details and also illustrates rankings for shortlisted social media and concludes one platform to carry out simulation case studies. (5) *Data flow diagram* helps illustrate the flow of information being simulated in later case studies. (6) *IT requirements to fulfill operations' activities* discusses conventional IT approaches vs the approaches to be taken by the highest ranked social media platform (Google+). (7) *Case studies* validates information management via social media by simulating practical activities within the WBS of a small construction business. (8*) Constraints of social media* highlight the information management activities that cannot be accomplished through social media. And a gap analysis of social media vs other ICT has been achieved under subheading (9) *Google+ vs Prolog expense*. Finally, a conclusion of this thesis.

Work Breakdown Structure (WBS)

The Work Breakdown Structure (WBS) displayed in APPENDIX A-1 and A-2 gives an overview of the divisions that are dealt with on a daily and weekly basis by a small contractor – this data has been referenced for this research. A small contractor has <15 employees, including titles such as: CEO, VPO, office administrator, field administrator, superintendent, foreman and others. The divisions of small contractor's WBS consist of: 1.0 the company's philosophy, 2.0 starting a job, 3.0 bidding, 4.0

contracts, 5.0 field supervision and 6.0 project closeout. Each division given has a list of processes within them that are displayed in APPENDIX A-3 and A-4.

Finalizing Operations for Case Studies

The operations that have been focused on for this particular research – using social media to perform construction operational activities for a small contractor – is division 5.0 field supervision. A breakdown of the operational processes is shown in APPENDIX A-4. 5.0 Field supervision operations has been chosen because of the variety of conventional IT approaches that are involved with completing activities within this division such as: sending information, receiving information, generating information, filing information, monitoring information, and creating information throughout the duration of a project. Choosing this division should bring about good results as social media attempts to handle a variety of conventional IT approaches, and possibly become an affordable alternative of information management.

Shortlisted Social Media

In chapter 2 of this study it was mentioned that businesses capitalize on using social media to their advantage. And that majority of business (according to a study in 2010) are using either Facebook, Twitter, LinkedIn or YouTube. Also mentioned in chapter 2 were the most popular sites to date by count of individuals that are members – listed here again (in no particular order): Facebook, Google+, Twitter, LinkedIn, YouTube and Instagram. Of these popular social media the researcher shortlisted those sites that may possess the functionality of handling tasks. Next, the shortlisted social media were matched against one another based on features and functions it would be able to offer.

Proposed Social Media

At this stage of the research a single social media platform was selected to handle later case studies. APPENDIX A-5 displays score rankings of shortlisted social

media. Rankings are based on the number of features and functions available to its users. The most critical features and functions were sharing documents, video calling and scheduling events. After cross analyzing their functional capabilities and determining which social media provided the most features it became evident as Google+ produced 32 features. And runner-up being Facebook, with 29 features. The platform with the most features of the shortlisted social media will carry out the researcher's case studies.

Data Flow Diagram (DFD)

The researcher created a Data Flow Diagram (DFD) to help illustrate the flow of information being analyzed within later case studies, shown in APPENDIX A-6 and A-7. The processes being analyzed under division 5.0 field supervision of WBS of small contractor are as follows: 5.1.1.1 schedule site activities, 5.1.1.2 site supervision, 5.1.1.3 write daily report, 5.4.1 create safety policy, 5.4.2 create safety presentation, 5.4.3 execute safety meeting, 5.4.4 create safety report and 5.4.5 evaluate effectiveness of safety policy. The activities involved within the processes listed above involve sending information, receiving information, and generating information, filing information, monitoring information, and creating information throughout the duration of a project. These activities will be simulated through virtual demonstrations of enabling construction operations' information management via social media.

IT Requirements to Fulfill Operations' Activities

Before the approach of social media handling construction operations' information there has been many other methods to deal with day-to-day activities – some more conventional than not (ex. using email to discuss future plans or observing work set in place via site visits). APPENDIX A-10 details a list of conventional approaches vs. social media (Google+) approaches per selected activity of the case studies. APPENDIX A-10 highlights the approaches that will be taken to develop results for technical feasibility of using social media to handle construction operations' information management.

Case Studies

The researcher begins developing results for Google+ approaches. The first step of managing information for construction activities starts with creating a Google+ account, which then will allow users to carry out information management using its many functions. In order to create an account a person must first have these 3 critical items. (1) A cloud storage that will save documents, spreadsheets, pdf and photos is needed to upload and link files onto social media (Google+). (2) A device with internet access is required, to be able to access the internet. (3) Internet availability, something that can be purchased in even the most remote locations. These items are fairly inexpensive.

Cloud storage is available for free up to 15GB of storage space. After that limit has been acceded unlimited storage can be purchased, at a current minimum, $10 per month. A device with internet access can be a smart phone, laptop or desktop. Smart phones and laptops can vary in price due to brand and features. So the cost depends on contractor's preference. Internet access for a small business at one site location is available for monthly billing as low as $59.95 per month. So expense totals for using Google+ information management requires purchase of technology with internet access and reoccurring monthly charges for internet and cloud storage of over 15GB (if needed).

After obtaining cloud storage, a device with internet access and internet a user can then create themselves a Google+ account to begin managing information of operational activities. In setting up a Google+ account a user must go onto the internet and sign up to be a member. Becoming a Google+ member takes a few steps of filling out information. The information required to create an account is: first name, last name, any email address (even if it is not a Google email address), a password, birthdate, gender and cell phone number in order to verify the account via a text message. After verifying account through email and or text message a user will then have full access to

their Google+ account. When first logging in the account holder will be prompted to add a photo of themselves and also befriend any other person that has a Google+ account. Proceeding all mentioned steps, a new Google+ member is now free to use all functions of the account as they please.

Next, users can create their own circle in Google+ account members. This circle allows the capability to share information to Google+ users of their liking vs shared information being publicly accessible to all plus members. Figure 4.1 displays the 1st page that users begin to create their accounts.

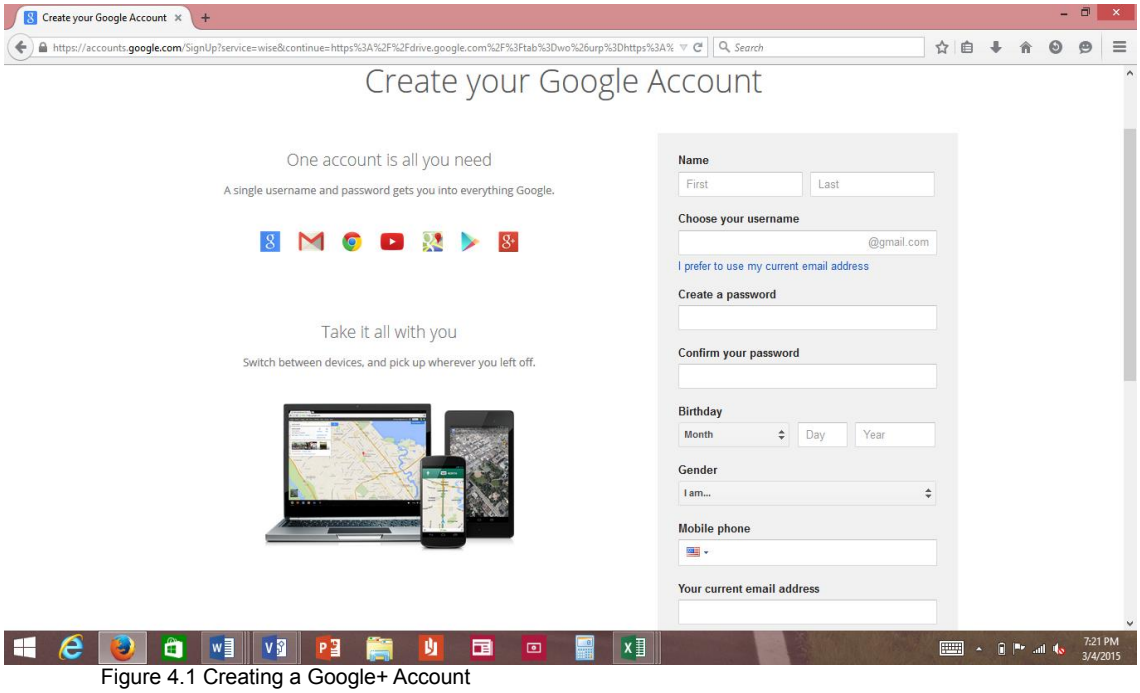


Figure 4.1 Creating a Google+ Account

5.1.1.1 Schedule site activities – give and receive input on creating a schedule, from managers and superintendent. When creating an effective construction schedule the personnel in charge of creating that schedule must take into consideration the input from managers and field superintendent.

Step 1. Go to *Home* page – link located upper-left drop down menu.

Step 2. Office manager starts *5.1.1.1 Schedule Site Comments* discussion by sharing text on Google+ bulletin stream using personal Google+ account. The text should only be shared to Google+ accounts within *Site Work Circle* if the discussion is to remain private. Figure 4.2 displays sharing text via Google+.

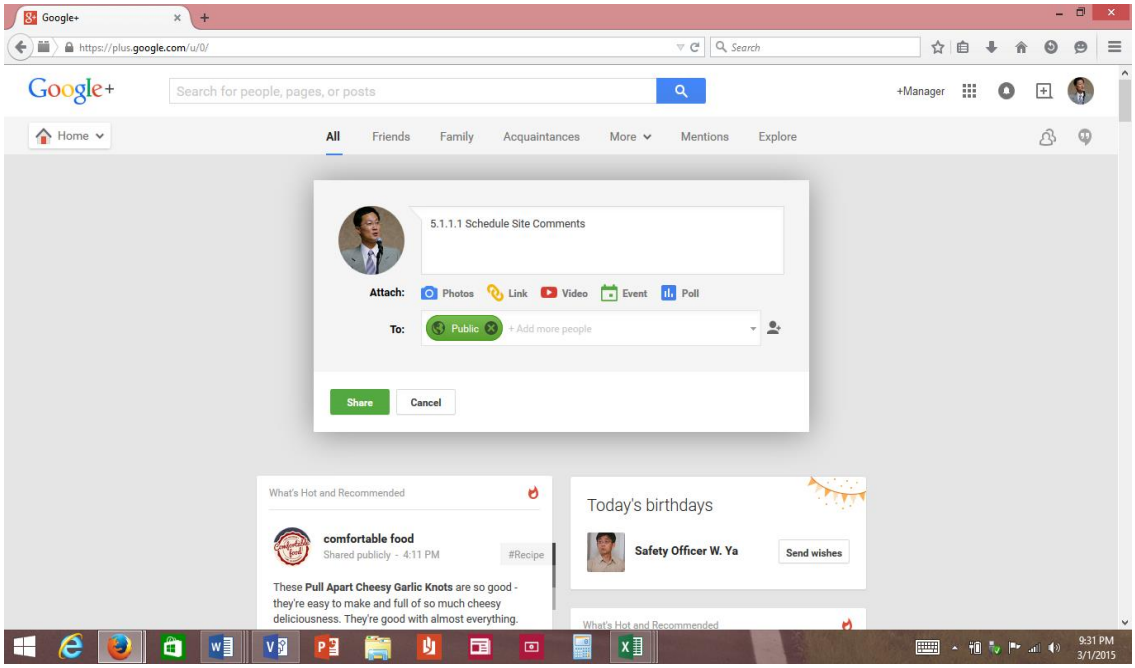


Figure 4.2 Sharing Text

Step 3. Field Superintendent makes a comment on discussion *5.1.1.1 Schedule Site Comments* using personal Google+ account. Figure 4.3 displays commenting via Google+.

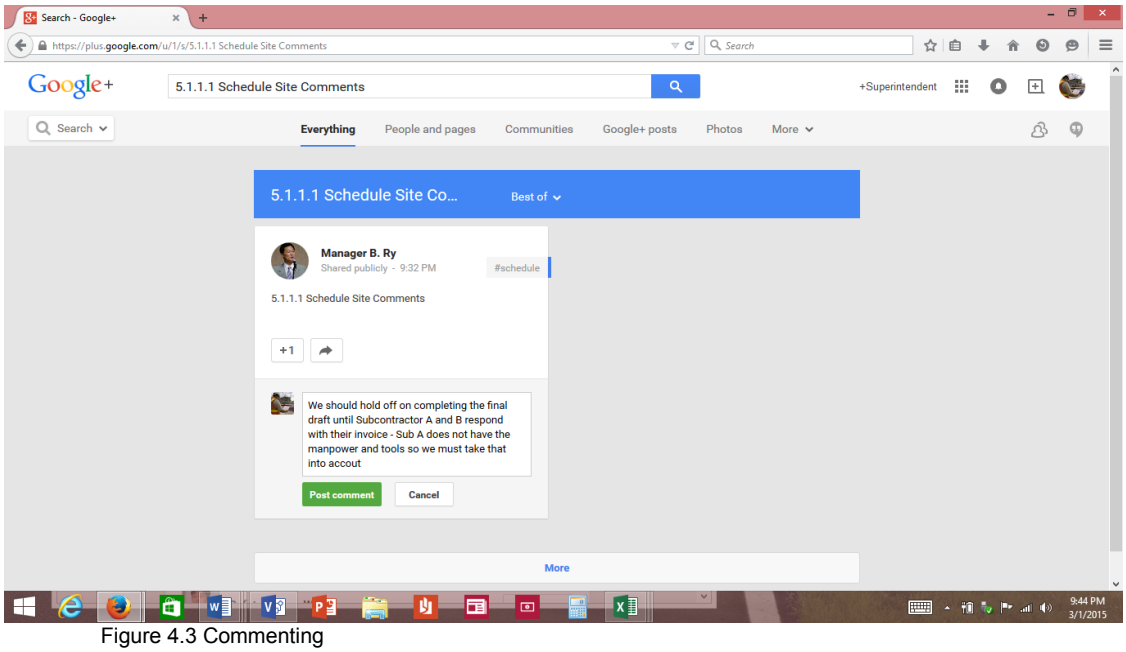


Figure 4.3 Commenting

Step 4. In order to access and view *5.1.1.1 Schedule Site Comments* someone must be logged into a personal Google+ account and viewing privileges must be enabled (for that account) if the poster has restricted the discussion from being shared publicly.

5.1.1.1 Schedule site activities – creating weekly and 8 week program. A schedule must be created in order to foresee work that needs to be done on any project. Figure 4.4 displays creating an event in Google+.

Step 1. Go to *Events* page – link located upper-left drop down menu.

Step 2. Create a Google+ event for *pouring concrete* and only invite other Google+ accounts within *Site Work Circle* if the created event should remain private.

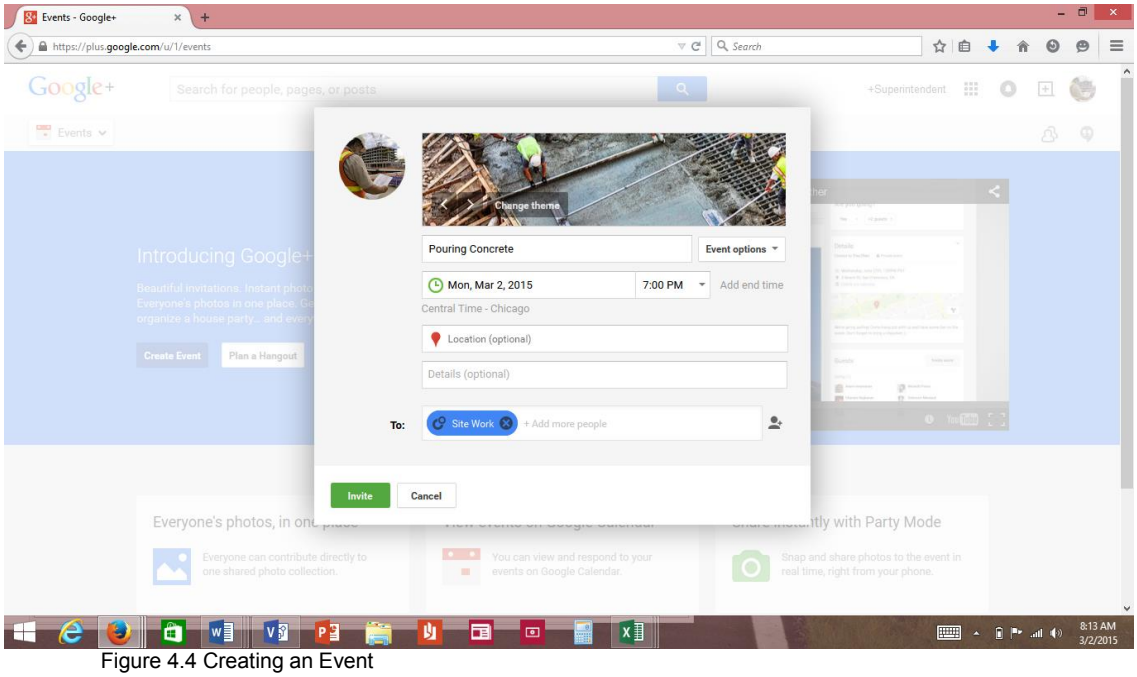


Figure 4.4 Creating an Event

5.1.1.2 Site supervision – evaluating subcontractor progress. During construction it is extremely important to monitor the work to ensure the project is completed on time and on budget, while meeting immediate regulations and quality standards. Assuming personnel is not on-site and needs to monitor work being set in place then there are options, such as: video calling someone who is on-site to livestream work-in-progress, someone on –site can capture and share pictures of work-in-progress and/or someone on-site can record and share videos of work-in-progress. Figure 4.5 displays the video chat start up in Google+ *Hangouts* and Figure 4.6 shows a screenshot of inviting other users to the video chat to begin monitoring work. Figure 4.7 displays a video chat of monitoring work in progress.

Step 1. Go to *Hangouts* – link located upper-left drop down menu.

Step 2. Start a V*ideo Hangout* – link located bottom left of Google+ hangout's page. If the required software has not been installed on your computer this step will take a few minutes to set up the video chat. Then invite superintendent or Google+ accounts in Site Work Circle.

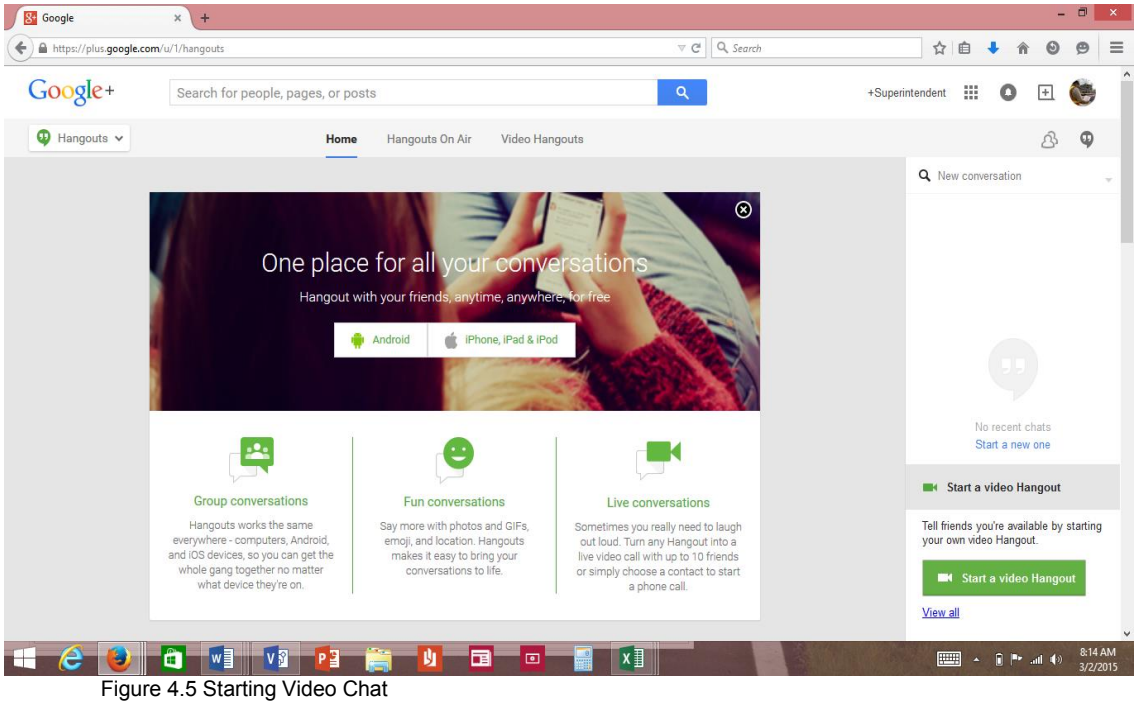


Figure 4.5 Starting Video Chat

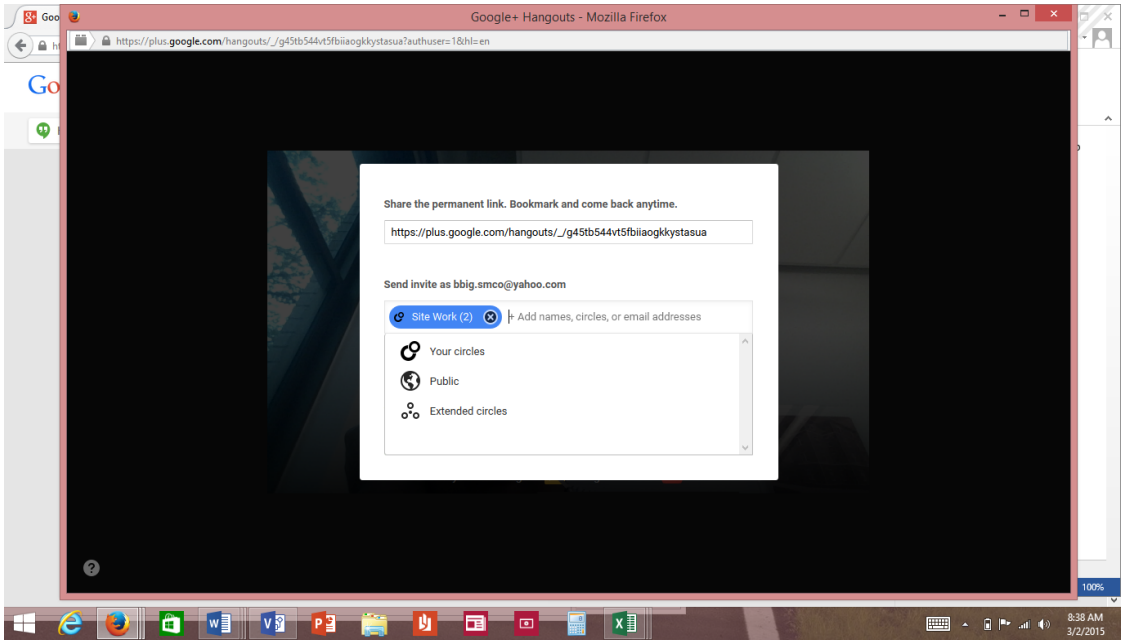


Figure 4.6 Inviting Members to Google+ Video Chat

Step 3. Through video chat, monitor work in progress.

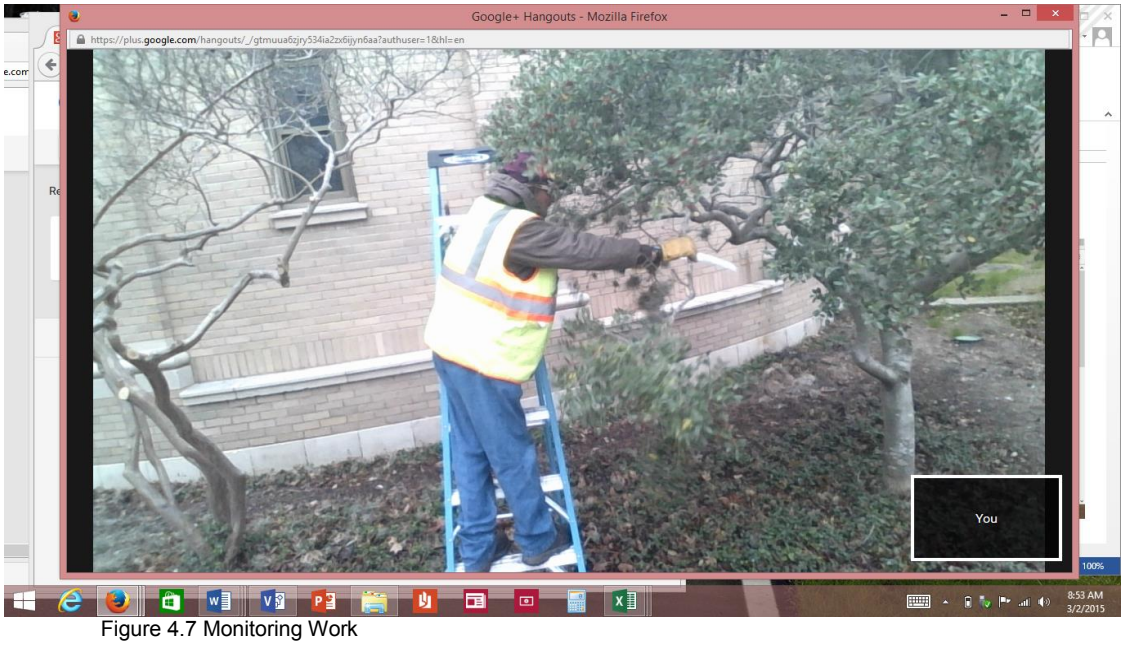


Figure 4.7 Monitoring Work

5.1.1.3 Write daily report – filing documents. Throughout the duration of construction projects (small and big) filing documentation is and effective approach to storing information in folders – per category, and in a particular way that makes sense to the user. Figure 4.8 displays document filing.

Step 1. Obtain document link from cloud server.

Step 2. Go to home page and share link. If the daily report shall remain private, only share invitations to Google+ account users that are authorized.

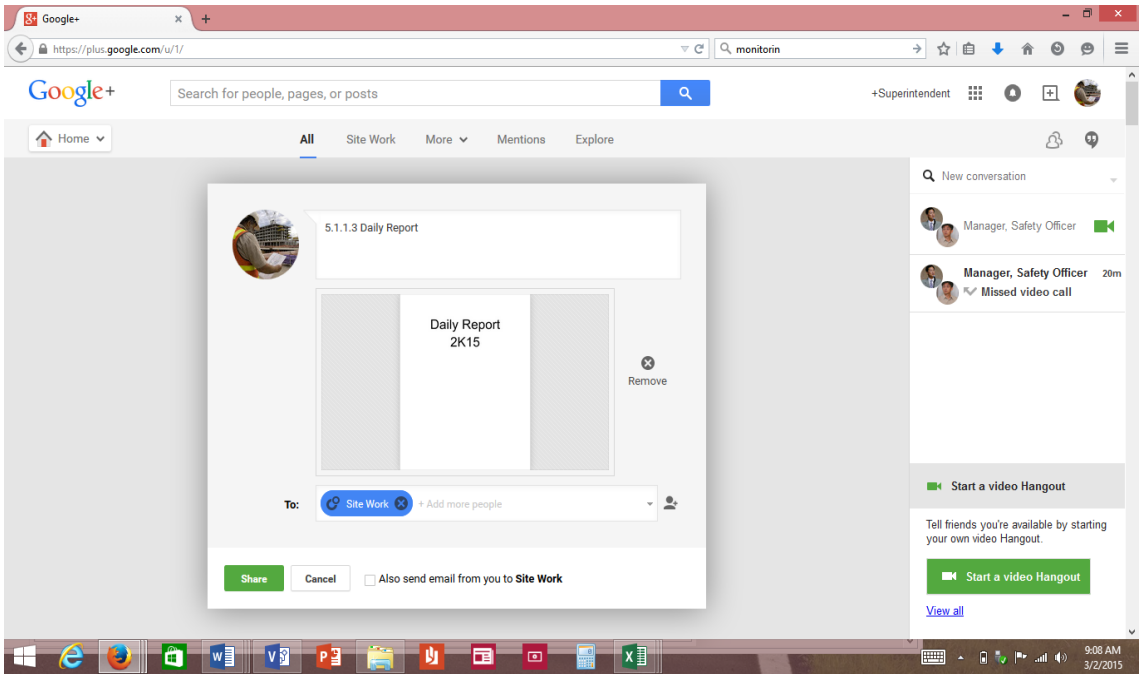


Figure 4.8 Filing Documents

Step 3. To look up filed documents (via shared link) search for specified text *5.1.1.3 Daily Report*. Searches can be entered in *search box* denoted by white magnifying glass. Figure 4.9 displays file searching.

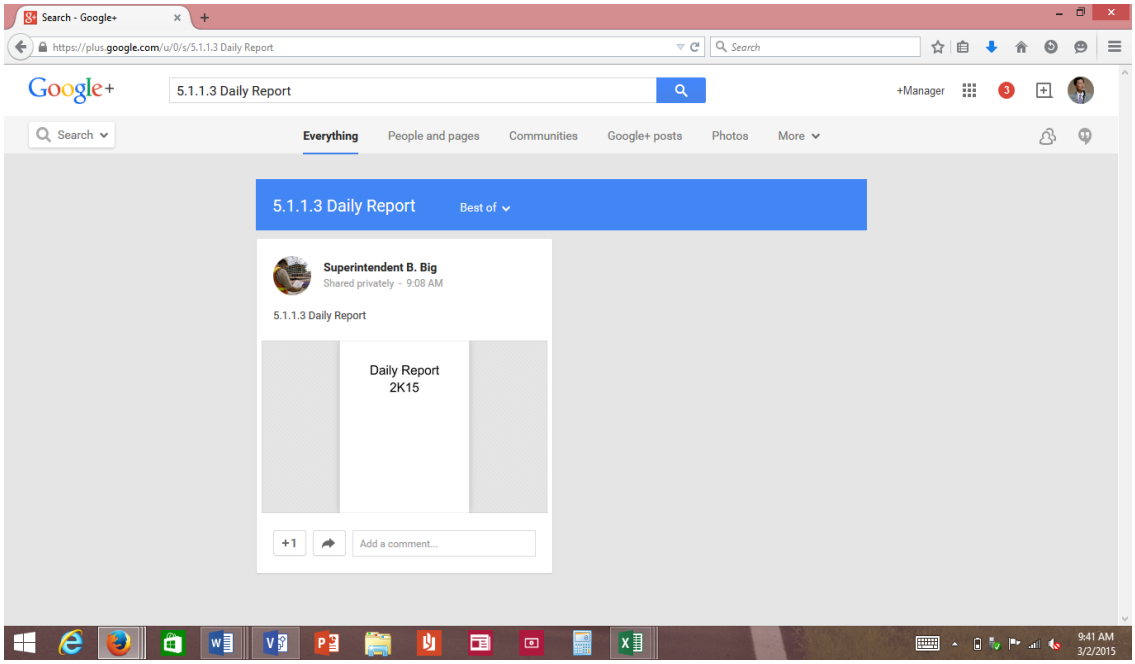


Figure 4.9 Search Files

5.4.2 Create safety presentation – creating safety presentation document. Throughout the duration of a project safety meetings take place to help supervisors supplement safety guideline to labor force. Safety presentations can be given using slide show presentation program. Figure 4.10 shows how to create a presentation.

Step 1. Create a *Communities page* in order to share a slide show presentation.

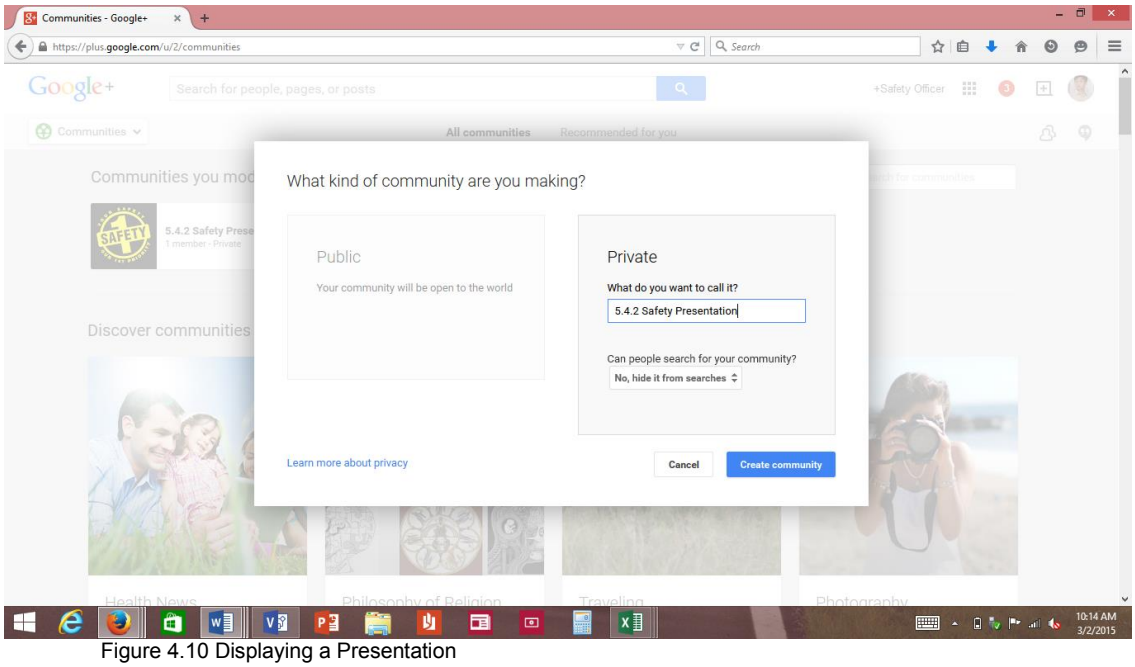


Figure 4.10 Displaying a Presentation

Step 2. In communities share to bulletin stream any specified text, photos, videos, events, polls and/or links that will assist a slide show presentation.

Step 3. In order to view presentation an account member must be a part of that community which has been created to present information regarding safety. Joining a private *Community* requires Google+ account users to accept invitation (located on the right of the ribbon denoted by bell shaped icon) or join. Figure 4.11 displays joining a community in order observe information created in presentations.

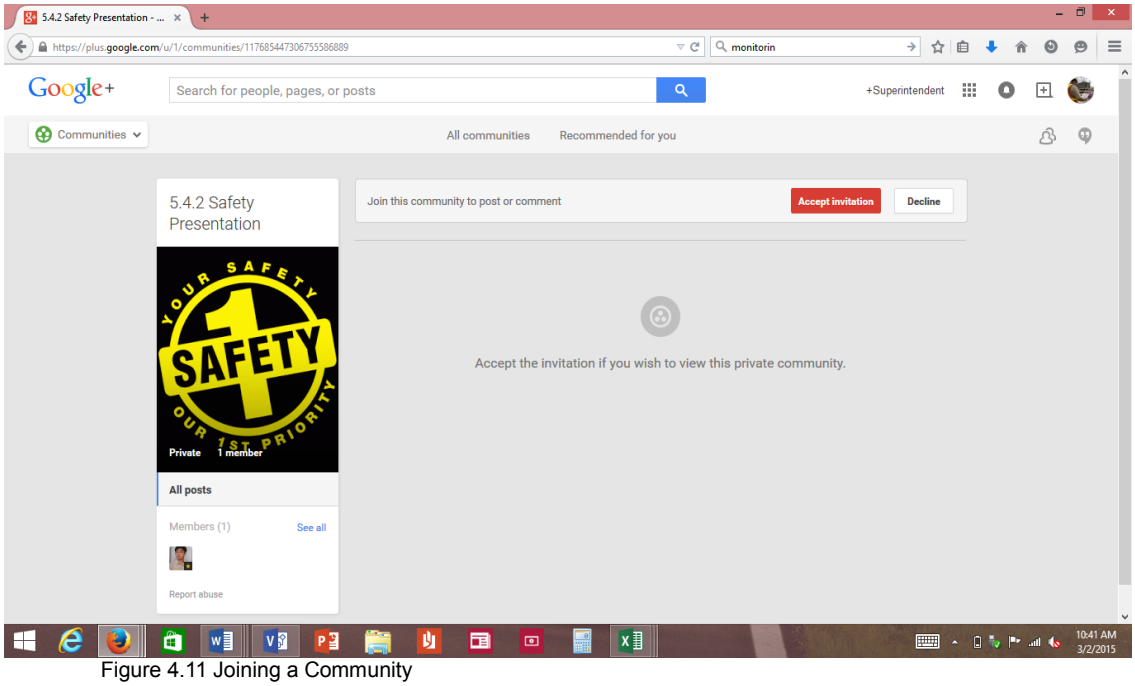


Figure 4.11 Joining a Community

5.4.3 Execute safety meeting – initiate safety meeting. Initiating a safety meeting boils down to who is informed and who will be present during the meetings.

Step 1. Initiate meetings to any Google+ account holder by inviting them to a safety presentation event or sharing information to users regarding safety meetings. Figure 4.12 displays the beginning of the initiation phase via Google+.

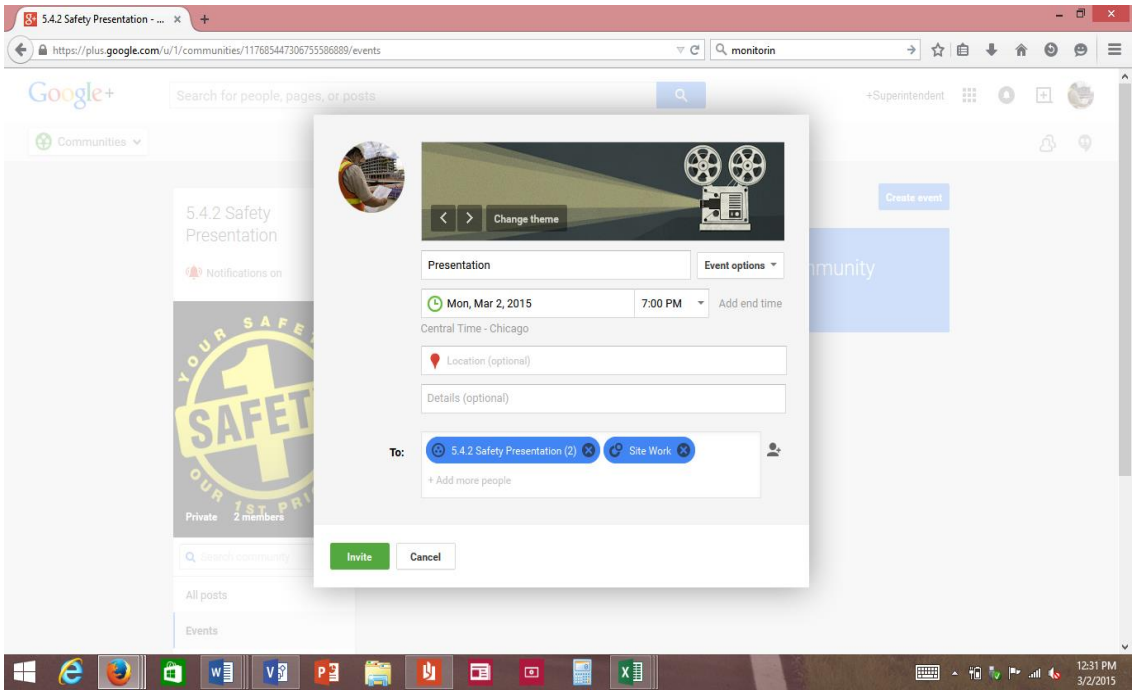
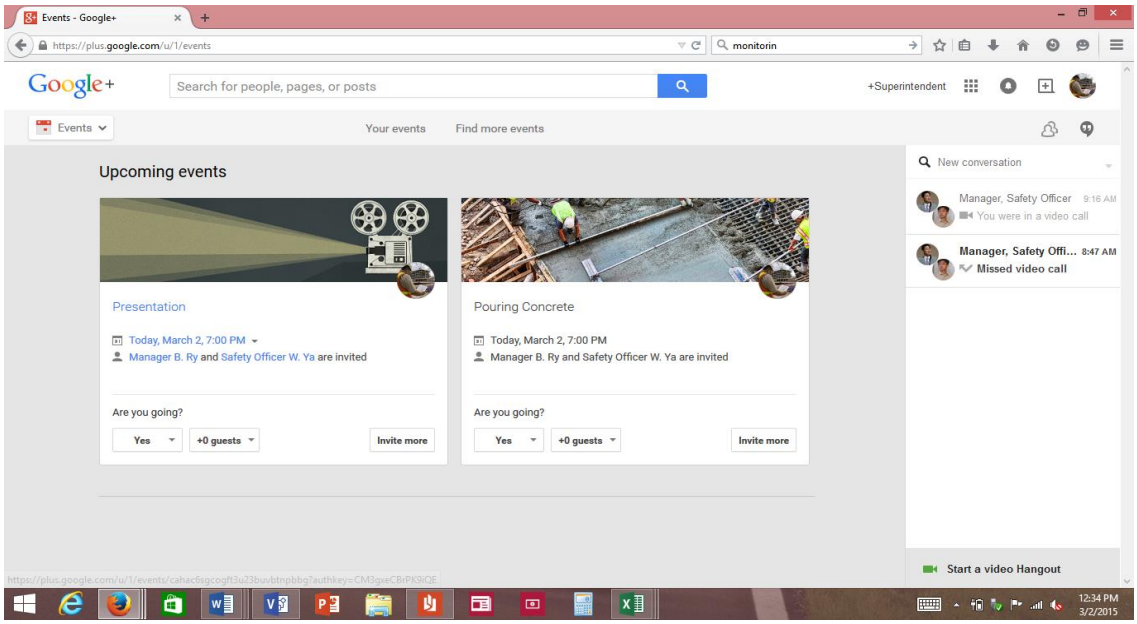


Figure 4.12 Initiating a Safety Meeting

Step 2. Invited members can confirm their attendance by either commenting or acknowledgement through “Are you going? yes-no” dropdown menu. Figure 4.13 shows a user’s display when accepting an invitation to any upcoming events or meetings.



4.13 Confirming Attendance to Safety Meeting

5.4.3 Execute safety meeting – giving safety presentation. The appointed safety officer is responsible for facilitating an environment where all site personnel (especially laborers) can learn how to be safe and look for job safety hazards. Figure 4.14 displays a presentation page layout via Google+.

Step 1. Go to community's page to view bulletin stream and present information

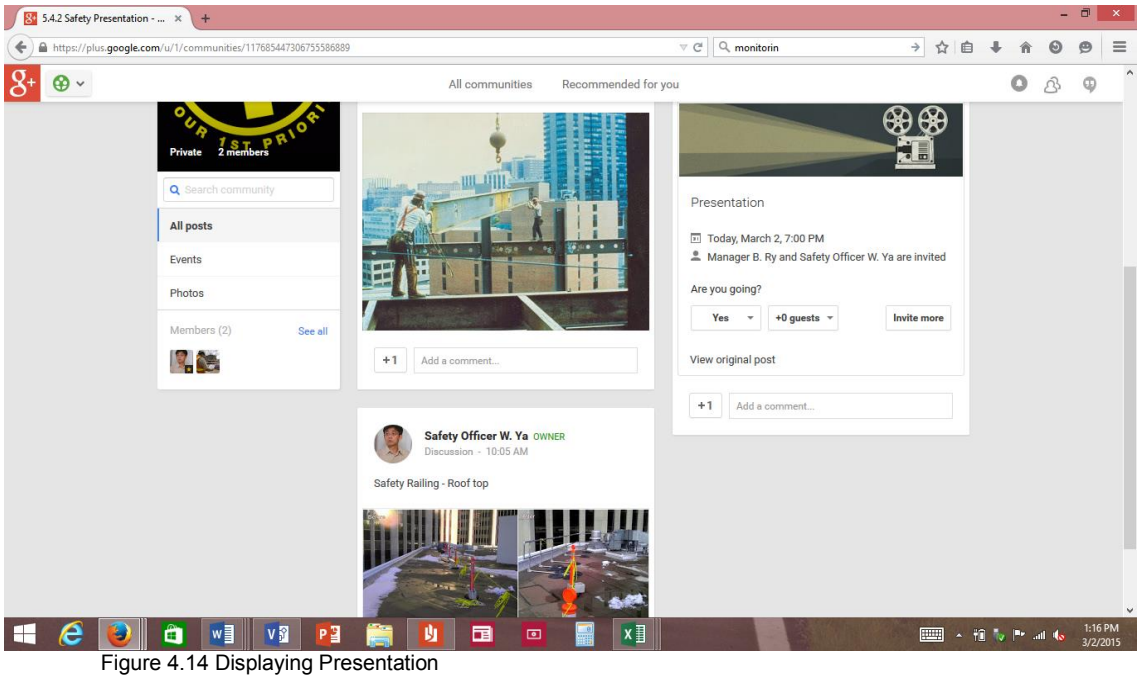


Figure 4.14 Displaying Presentation

5.4.5 Evaluate effectiveness of safety policy – collecting *5.4.1 Safety Policy Document.* When working with a problem or simply completing a task there is information that needs to be collected before solving the problem or continuing towards completion of said task. Figure 4.15 displays the collecting of information via Google+ search application.

Step 1. Make sure Google+ account has permission to view *5.4.1 Safety Policy Document.*

Step 2. To look up and retrieve filed documents (via shared link) search for specified text *5.4.1 Safety Policy Document*. Searches can be entered in *search box* denoted by white magnifying glass.

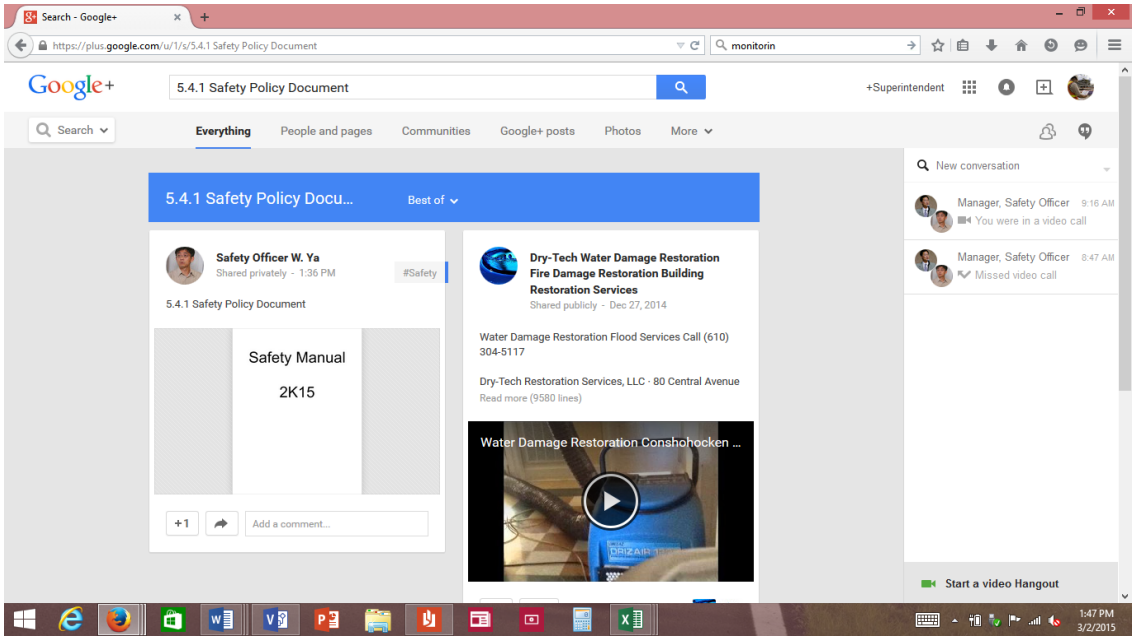


Figure 4.15 Retrieving Content

Constraints of Social Media

The constraints of social media handling information management rely in activities that require the use of creating word documents, spreadsheet documents and also having no implications towards BIM technology. Being able to edit word documents allows for managers to generate memos, deliver policies and guidelines within the company and make out contracts such as change orders or submittals to be shared outside of the company. Any spreadsheet document editor is meaningful when creating invoices, punch lists, budgets and other critical logs that assist during phases of a project such as cost controlling, purchasing, field administration, document control and reporting. Having implications toward BIM technology allows collaboration with innovative designers. The advantages of BIM are visualizing what is to be built in a simulated environment by looking at 3D models, leading to fewer errors and corrections in the field. These constraints of social media lead to finding affordable solutions (outside of social media) through other open-sourced IT that can facilitate constrained information management activities.

Google+ vs Prolog Expense

To gain a better understanding of how affordable Google+ is against other information management software the researcher conducts a gap analysis of startup expenses. This gap analysis involves a PMIS system that is popular among contractors that also revenue over $50 million a year. The information management software being analyzed against Google+ is Prolog. Prolog software is a leading project management information solution used by contractors for managing project information daily. This software is built for PMs that are accountable for construction costs, scope and schedules. The software can be acquired by purchase of a license costing $2,000 to $3,000 per user. This software also requires an internet device and internet availability but instead of using a cloud storage, files can be managed from a local drive and linked to Prolog at no expense.

Next page, figure 4.17, shows a graph illustrating expenses for using Google+ vs Prolog over 36 months following initial startup cost (pricing does not include inflation). This is a virtual scenario that assumes the contractor has not yet purchased any items to facilitate information management from the office to the field. In accordance with figure 4.17, items that are included in Google+ expenses are: two $700 laptops, two free accounts with Google+, cloud storage at $10 per month and internet for the office and site location at $59.95 per month. Prolog expenses include: two $700 laptops, two $2,500 licenses with Prolog, internet for the office and site location at $59.95 per month, and an annual software upgrade fee that estimates near 25% of initial product cost equaling $625.00. Google+ has a startup expense of $1529.90 following a monthly fee of $129.90. While Prolog has a startup expense of $6519.90 following a monthly fee of $119.90 and annual fee of $625.00. Figure 4.16 illustrates the table for software and hardware expenses when facilitating information management via ICT. This figure does not include soft-cost (ex. overhead for training and periods of reduced productivity).

	Software		Hardware	
	Startup Package	**Annual Upgrades**	**Internet**	**Computer***
Prolog	$2500.00/user	$625.00/year	$59.95/mo	$700.00
Google+	-------	-------	$59.95/mo	$700.00
			*price varies on user preference	

Figure 4.16 Software and Hardware Expenses

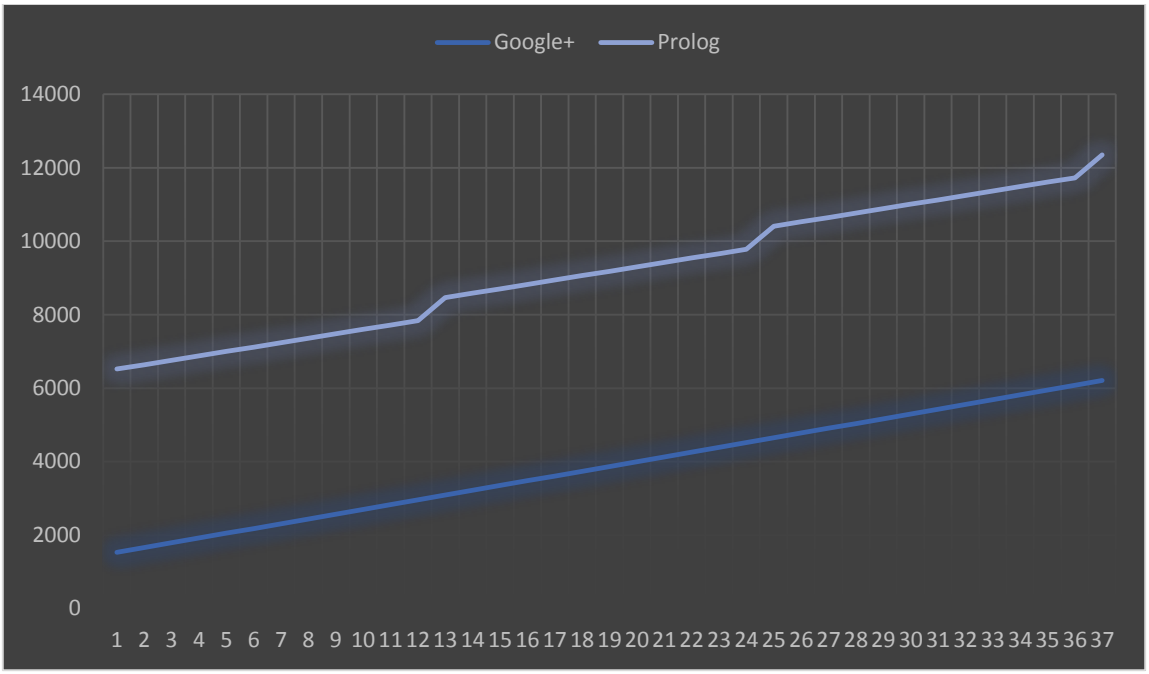


Figure 4.17 Google+ vs Prolog Expense over 37 Months

Conclusion and Results

In this paper, we began with how the construction industry in America has not yet moved toward effectively implementing innovative IT within their company strategy. We continued to understand how this new and innovative IT might be costly to the majority of “small construction business related establishments” who make up the larger percent of the construction industry. But it is imperative to every construction professional (large or small) that they effectively manage information throughout the duration of their business. As well as it is just important for small business to be competitive in managing information just as effective as larger businesses whose budget is set forth on innovative IT software. So a viable alternative – social media – was proposed because it being an inexpensive tool that can potentially benefit toward effectively managing information in the construction industry. This suggestion is what lead the researcher in studying the feasibility in social media handling information management of construction operations for a small contractor.

Using an affordable IT solution to manage information of a small contractor was the aim of this study. After concluding qualitative analysis and several case studies aimed toward using social media platform Google+ to handle construction activities the evidence finds social media a viable alternative. The cost of implementing social media results in a reoccurring monthly expense of $10, due to unlimited cloud storage. That cost being very inexpensive in comparison to licensing Prolog (a premium PMIS software) for a one-time expense of $2,500 per user. The technical feasibility of enabling information management conclude these activities (and of the sort): discussions, schedules, documentation, subcontractor progress, presentations, initiating meetings, tracking personnel– all which can be created, evaluated, shared, edited and deleted at any time. The constraints of Google+ handling any information activities are enabling the creation of word documents, spreadsheet documents, and having any implications toward BIM, which could yield activities such as: creating contracts, creating budgets, quantity takes offs, punch lists and viewing 3D models.

The benefits of this research has given Google+ the title “Most applicable of the social media for information management” – going as far as features and functionality. Also social media (Google+) has proven the ability to handle a majority of construction operational task to the benefit of “small construction business related establishments” because it is an affordable tool – having only these prerequisites: cloud storage drive and internet access. Now businesses that have chosen to allocate the majority of their resources toward items beside information technology can innovate with affordable ICT allowing them, like high performing companies (ex. MEDCO Construction LLC, AECOM Inc., Bechtel, Enthalpy and others), to enable effective information management, create management strategies, potentially prevent risk and reoccurring errors on every project.

Future studies can provide research on a variety of benefits via social media in the construction industry from aspects such as technicalities, operations and functionalities. Also more gap analysis can be done in order to figure the cost of using social media (Google+) against other conventional information managing methods besides Prolog.

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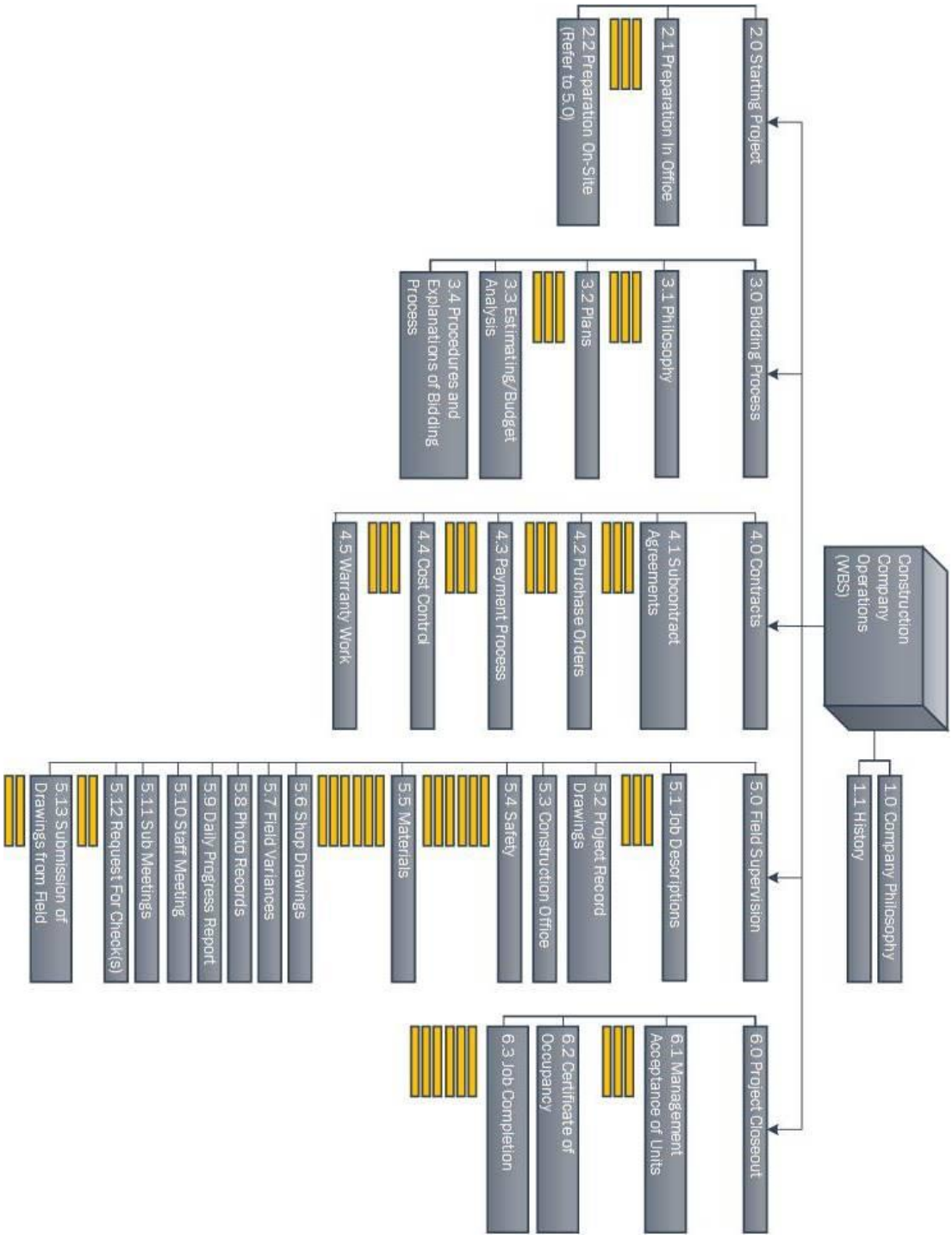
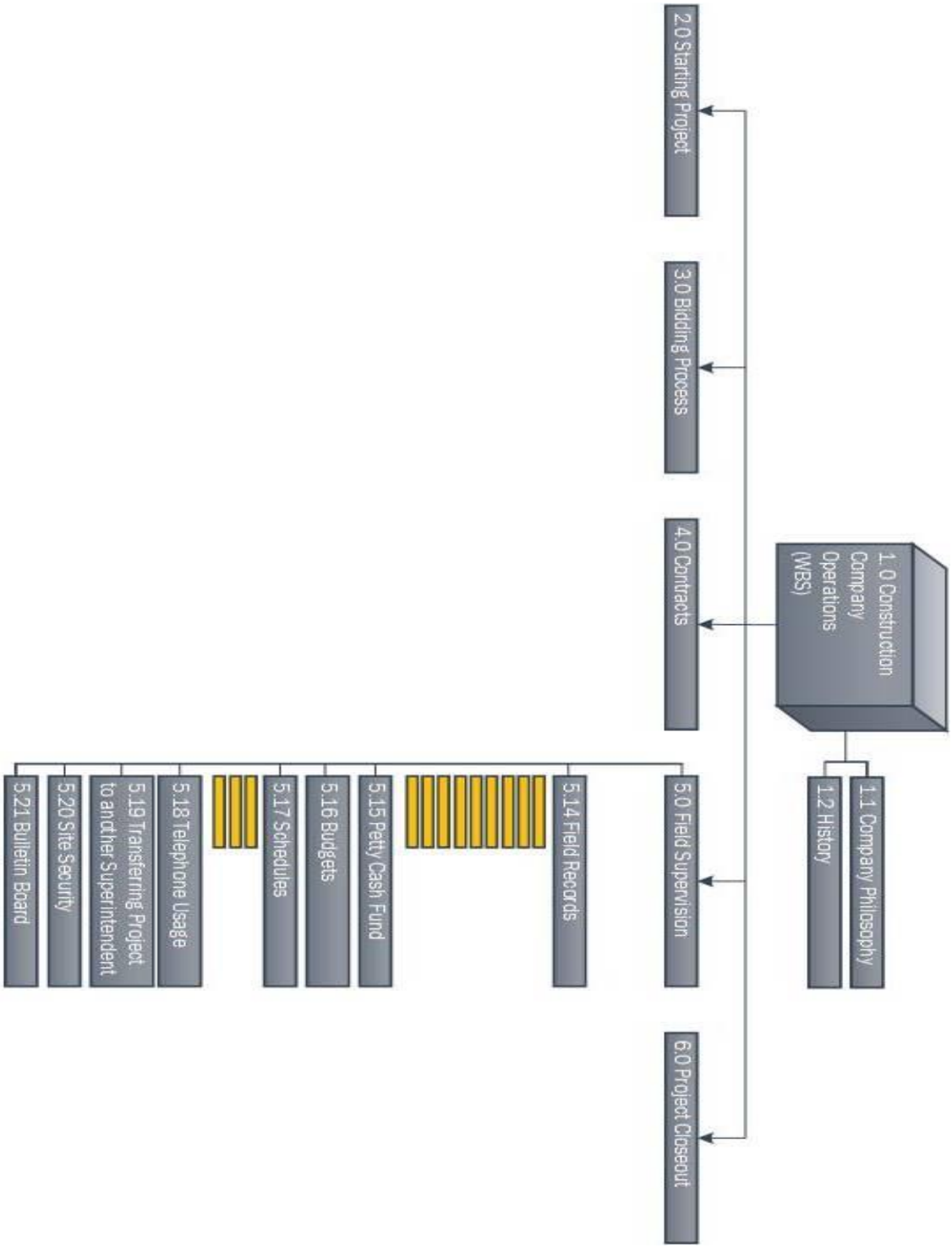
APPENDIX A

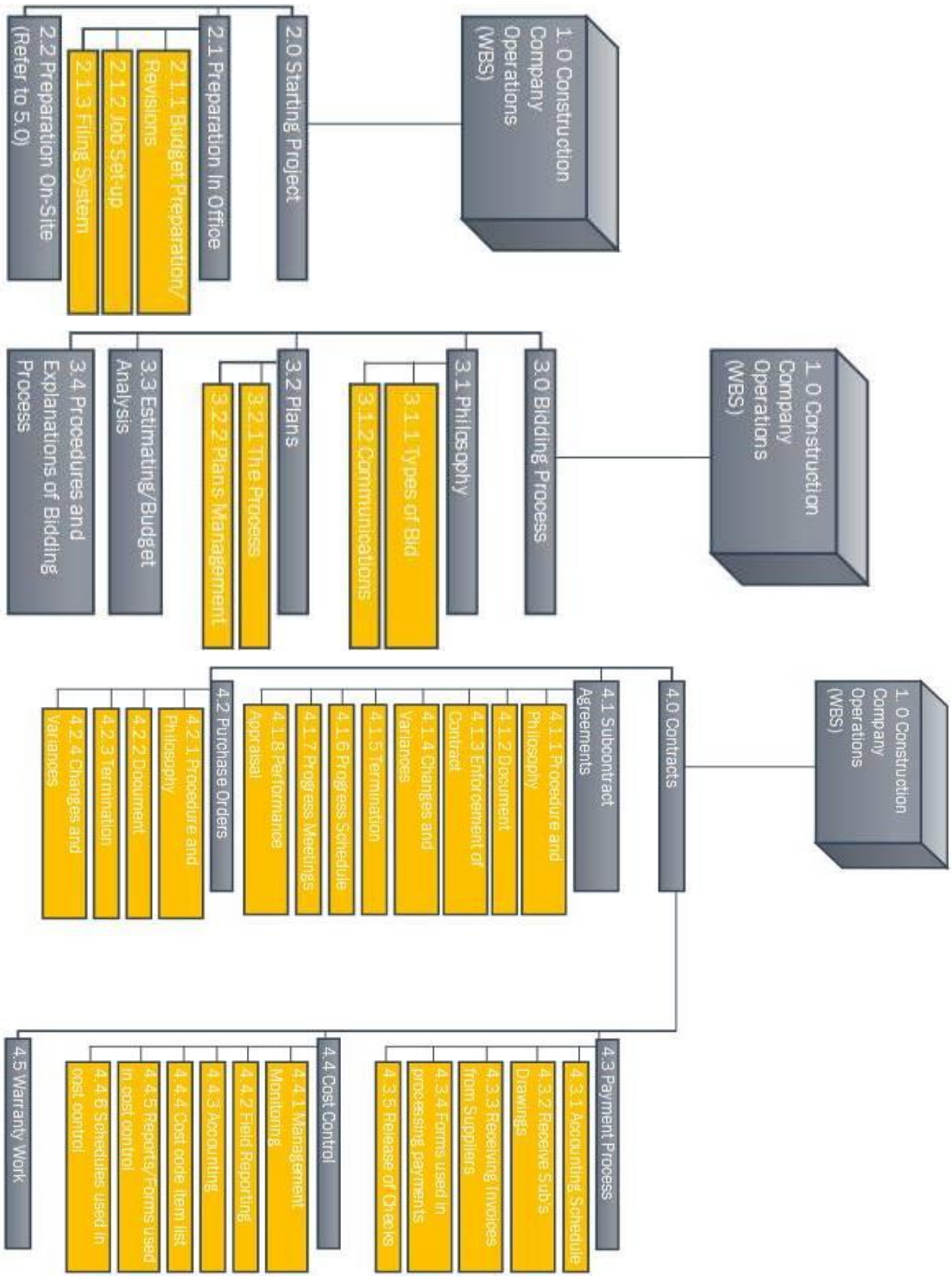
A-1



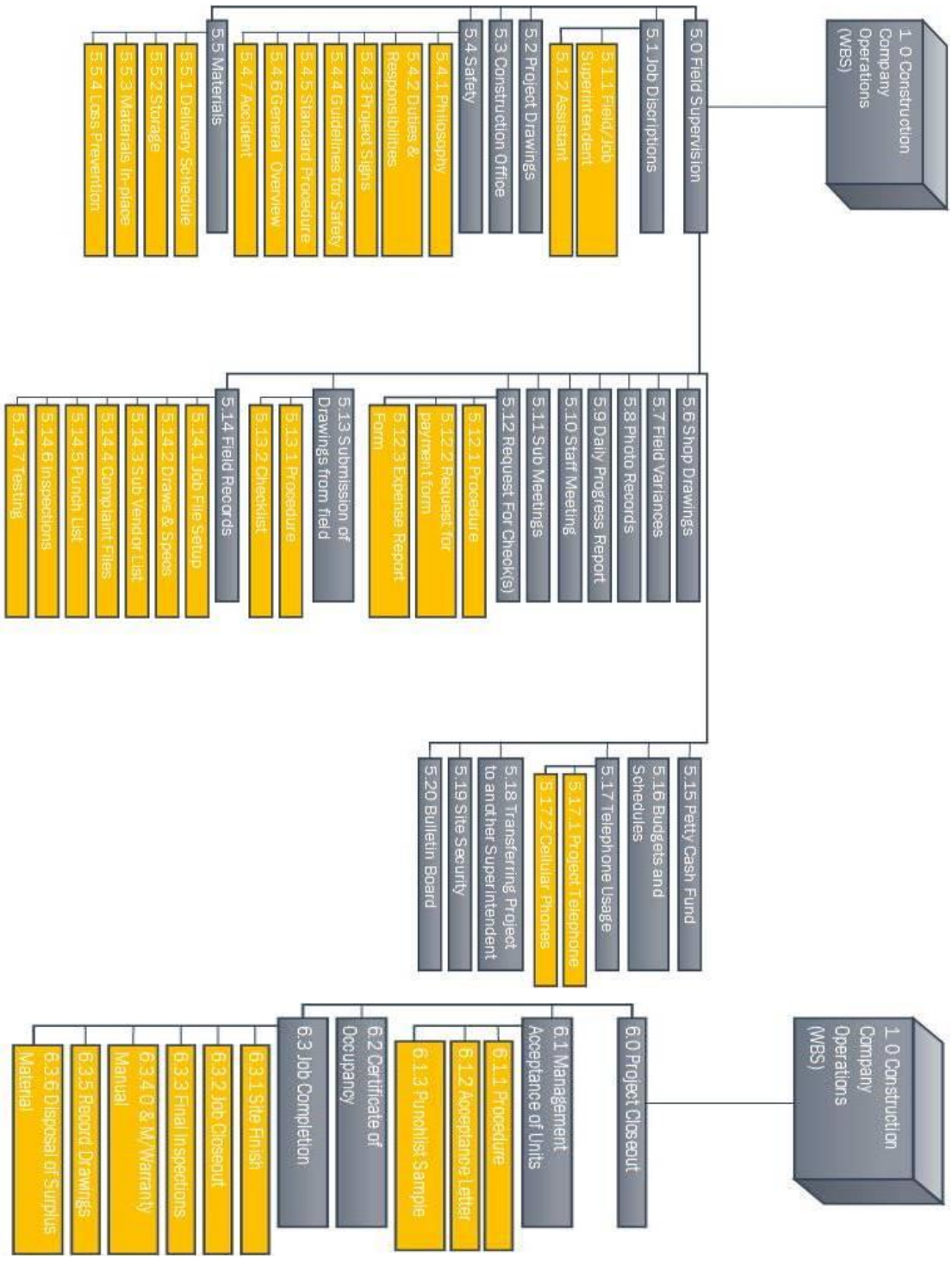
A-2


1. 0 Construction Company Operations (WBS)
1.1 Company Philosophy
1.2 History
2.0 Starting Project
3.0 Bidding Process
4.0 Contracts
5.0 Field Supervision
5.14 Field Records
5.15 Petty Cash Fund
5.16 Budgets
5.17 Schedules
5.18 Telephone Usage
5.19 Transferring Project to another Superintendent
5.20 Site Security
5.21 Bulletin Board
6.0 Project Closeout

A-3


1.0 Construction Company Operations (WBS)
2.0 Starting Project
2.1 Preparation In Office
2.1.1 Budget Preparation/ Revisions
2.1.2 Job Set-up
2.1.3 Filing System
2.2 Preparation On-Site (Refer to 5.0)
1.0 Construction Company Operations (WBS)
3.0 Bidding Process
3.1 Philosophy
3.1.1 Types of Bid
3.1.2 Communications
3.2 Plans
3.2.1 The Process
3.2.2 Plans Management
3.3 Estimating/Budget Analysis
3.4 Procedures and Explanations of Bidding Process
1.0 Construction Company Operations (WBS)
4.0 Contracts
4.1 Subcontract Agreements
4.1.1 Procedure and Philosophy
4.1.2 Document
4.1.3 Enforcement of Contract
4.1.4 Changes and Variances
4.1.5 Termination
4.1.6 Progress Schedule
4.1.7 Progress Meetings
4.1.8 Performance Appraisal
4.2 Purchase Orders
4.2.1 Procedure and Philosophy
4.2.2 Document
4.2.3 Termination
4.2.4 Changes and Variances
4.3 Payment Process
4.3.1 Accounting Schedule
4.3.2 Receive Sub's Drawings
4.3.3 Receiving Invoices from Suppliers
4.3.4 Forms used in processing payments
4.3.5 Release of Checks
4.4 Cost Control
4.4.1 Management Monitoring
4.4.2 Field Reporting
4.4.3 Accounting
4.4.4 Cost code item list
4.4.5 Reports/Forms used in cost control
4.4.6 Schedules used in cost control
4.5 Warranty Work

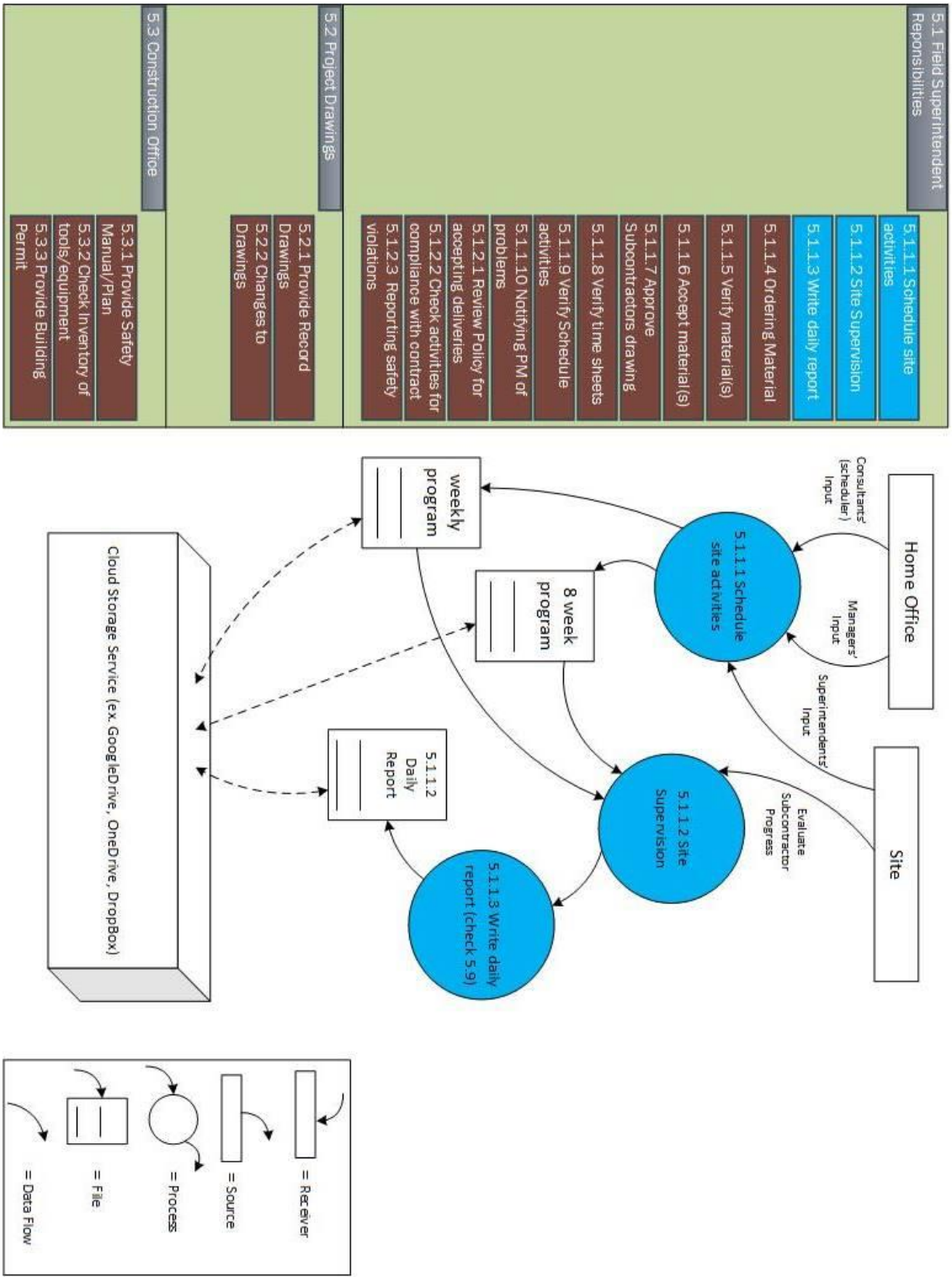
A-4


1.0 Construction Company Operations (WBS)
5.0 Field Supervision
5.1 Job Discriptions
5.1.1 Field/Job Superintendent
5.1.2 Assistant
5.2 Project Drawings
5.3 Construction Office
5.4 Safety
5.4.1 Philosophy
5.4.2 Duties & Responsibilities
5.4.3 Project Signs
5.4.4 Guidelines for Safety
5.4.5 Standard Procedure
5.4.6 General Overview
5.4.7 Accident
5.5 Materials
5.5.1 Delivery Schedule
5.5.2 Storage
5.5.3 Materials In-Place
5.5.4 Loss Prevention
5.6 Shop Drawings
5.7 Field Variances
5.8 Photo Records
5.9 Daily Progress Report
5.10 Staff Meeting
5.11 Sub Meetings
5.12 Request For Check(s)
5.12.1 Procedure
5.12.2 Request for payment form
5.12.3 Expense Report Form
5.13 Submission of Drawings from field
5.13.1 Procedure
5.13.2 Checklist
5.14 Field Records
5.14.1 Job File Setup
5.14.2 Draws & Specs
5.14.3 Sub Vendor List
5.14.4 Complaint Files
5.14.5 Punch List
5.14.6 Inspections
5.14.7 Testing
5.15 Petty Cash Fund
5.16 Budgets and Schedules
5.17 Telephone Usage
5.17.1 Project Telephone
5.17.2 Cellular Phones
5.18 Transferring Project to another Superintendent
5.19 Site Security
5.20 Bulletin Board
1.0 Construction Company Operations (WBS)
6.0 Project Closeout
6.1 Management Acceptance of Units
6.1.1 Procedure
6.1.2 Acceptance Letter
6.1.3 Punchlist Sample
6.2 Certificate of Occupancy
6.3 Job Completion
6.3.1 Site Finish
6.3.2 Job Closeout
6.3.3 Final Inspections
6.3.4 O & M Warranty Manual
6.3.5 Record Drawings
6.3.6 Disposal of Surplus Material

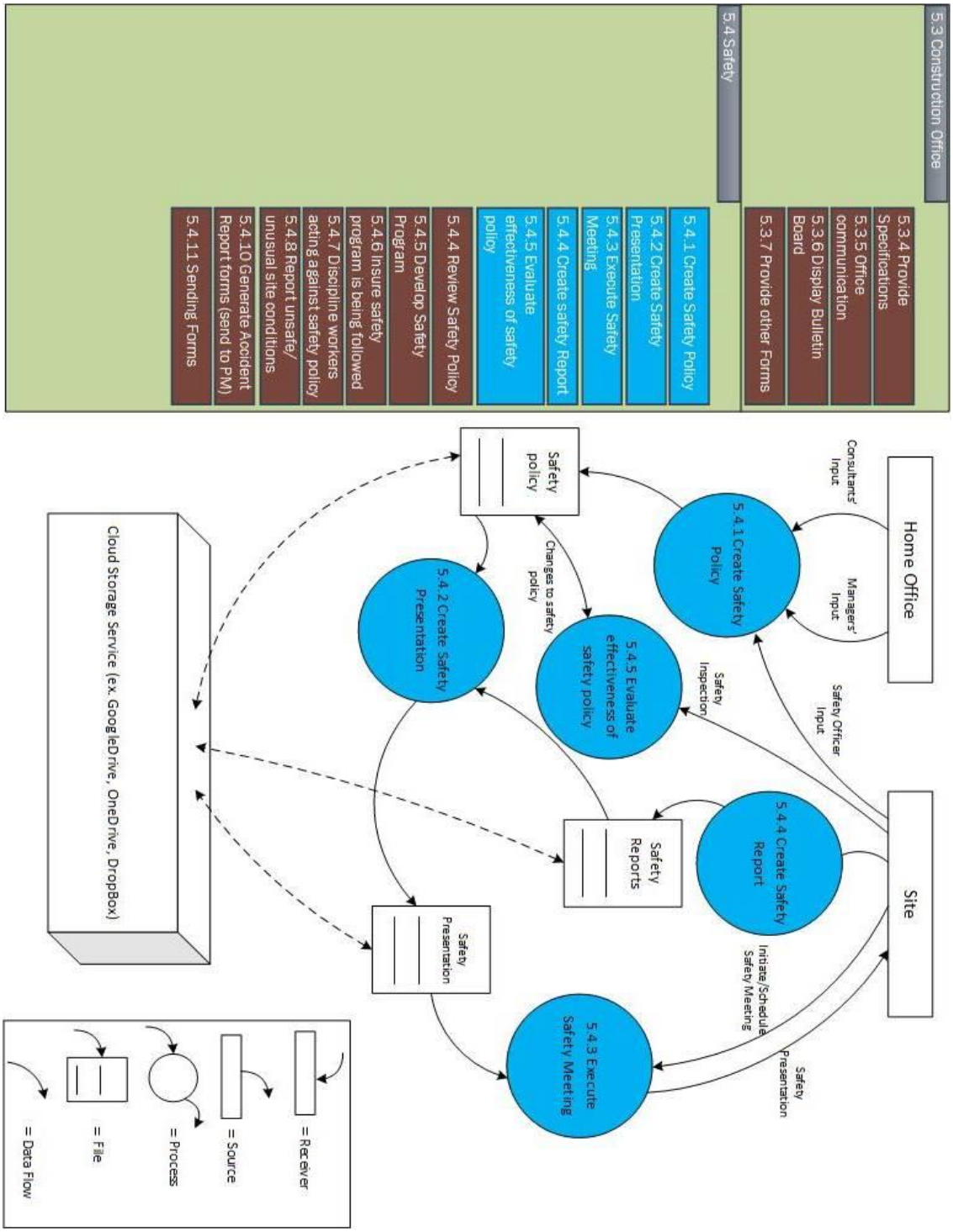
A-5

Features	Facebook	Google+	Twitter	Youtube	Instagram
Video Share	X	X		X	X
Video Upload	X	X		X	X
Video Search	X	X		X	
Content Access (outside of platform)		X	X	X	X
Smartphone Access	X	X	X	X	X
Photo Share	X	X	X		X
Photo Upload	X	X	X		X
Photo editing (crop)	X	X			X
Photo editing (filters)	X	X			X
Hashtag/Classify	X	X	X	X	X
Hashtag Search	X	X	X	X	X
Instant Messaging	X	X	X		
Messaging	X	X	X	X	X
Voice messaging					
Following/Friend	X	X	X	X	X
Chronological Content/Updates	X	X	X	X	X
Mentioning other users	X	X	X	X	X
Verified Users	X	X	X	X	X
User Comments	X	X	X	X	X
User Profile	X	X	X	X	X
Friends/Circles	X	X			
Groups/Communities	X	X			
Video Chat		X			
Document Share	X	X			
Scratchpad		X			
Location Share	X	X	X		X
Events: Share, Create	X	X			
Calendar: Share, Create	X	X			
News Feed: Following Activities	X	X			
Bulletin Board/Stream	X	X	X	X	X
Activity Notifications	X	X	X	X	X
Customer Connection	X	X			
Nuge Notification	X	X			
Total Features	29	32	17	16	20

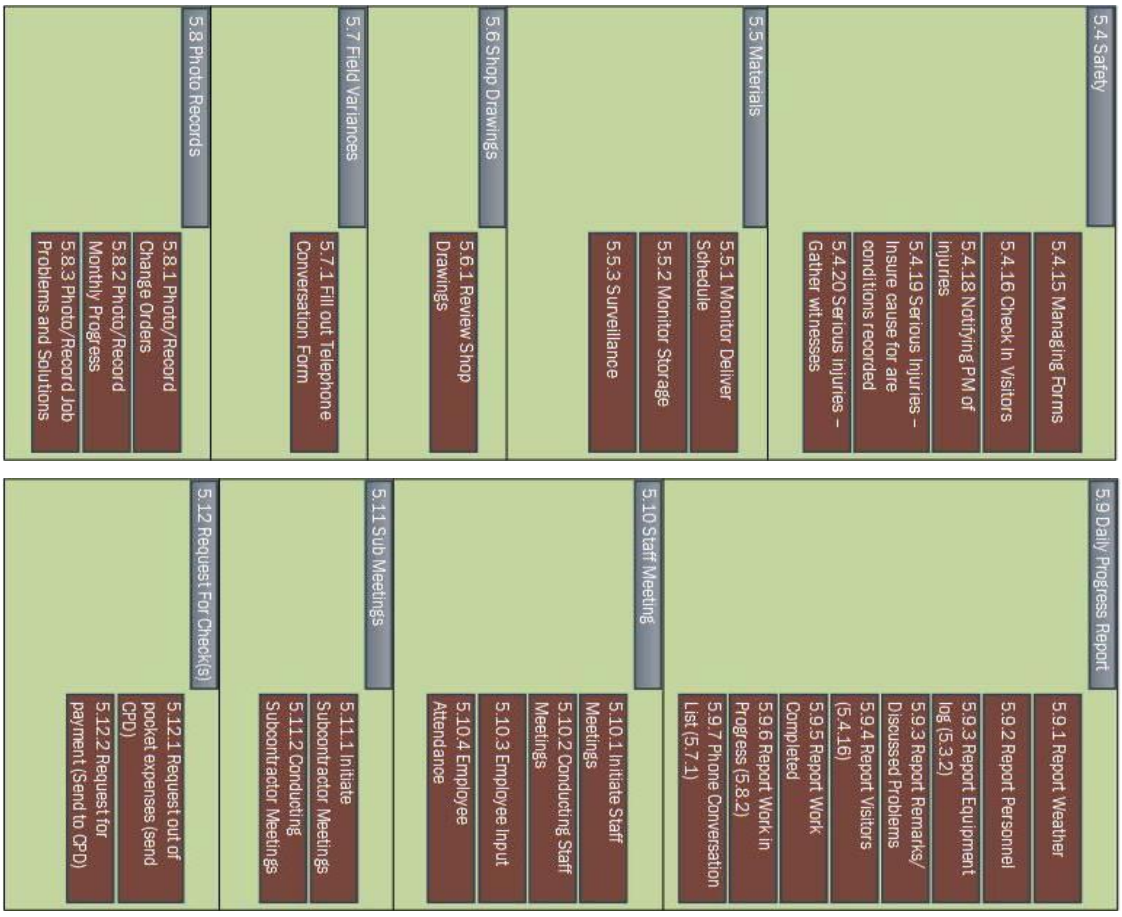
A-6


5.1 Field Superintendent Reponsibilities
5.1.1.1 Schedule site activities
5.1.1.2 Site Supervision
5.1.1.3 Write daily report
5.1.1.4 Ordering Material
5.1.1.5 Verify material(s)
5.1.1.6 Accept material(s)
5.1.1.7 Approve Subcontractors drawing
5.1.1.8 Verify time sheets
5.1.1.9 Verify Schedule activities
5.1.1.10 Notifying PM of problems
5.1.2.1 Review Policy for accepting deliveries
5.1.2.2 Check activities for compliance with contract
5.1.2.3 Reporting safety violations
5.2 Project Drawings
5.2.1 Provide Record Drawings
5.2.2 Changes to Drawings
5.3 Construction Office
5.3.1 Provide Safety Manual/Plan
5.3.2 Check Inventory of tools/equipment
5.3.3 Provide Building Permit
Home Office
Site
Consultants' (scheduler) Input
Managers' Input
Superintendents' Input
Evaluate Subcontractor Progress
5.1.1.1 Schedule site activities
5.1.1.2 Site Supervision
5.1.1.3 Write daily report (check 5.9)
weekly program
8 week program
5.1.1.2 Daily Report
Cloud Storage Service (ex. GoogleDrive, OneDrive, DropBox)
= Receiver
= Source
= Process
= File
= Data Flow

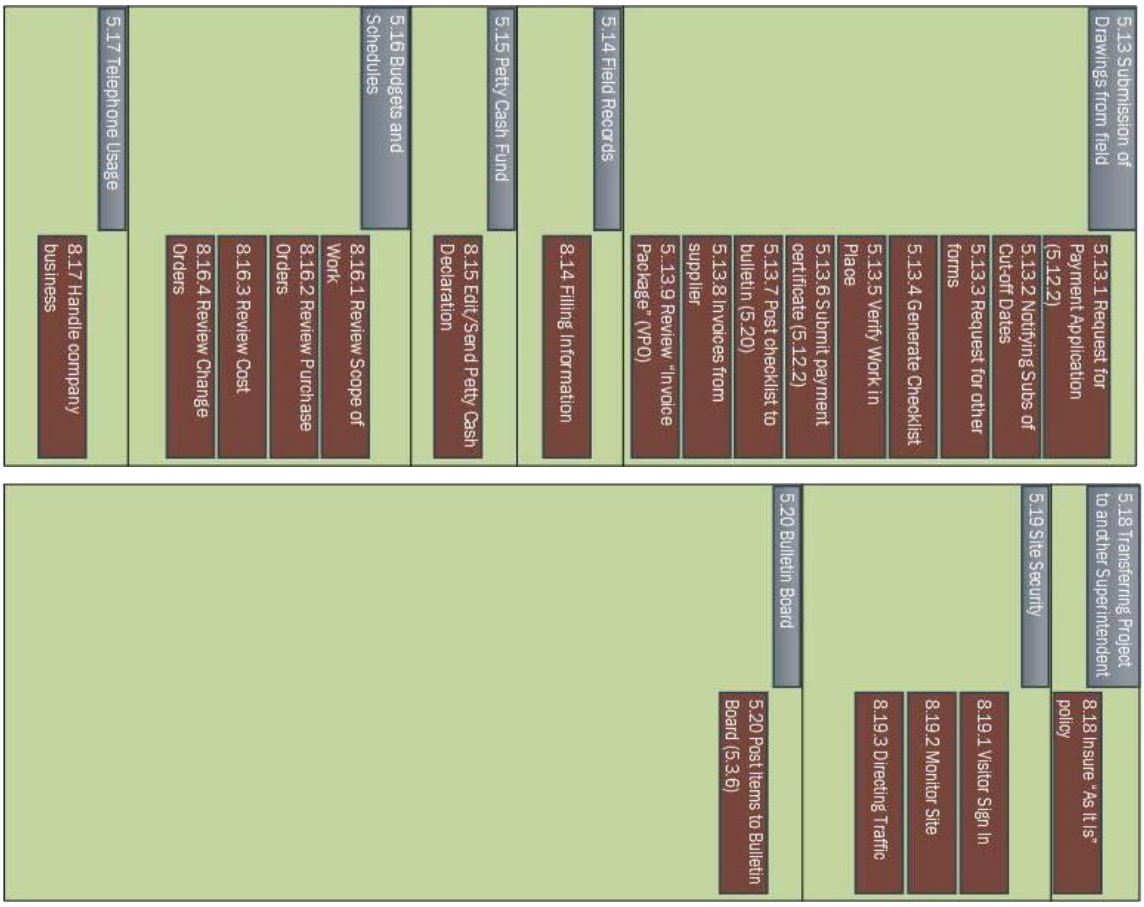
A-7


5.3 Construction Office
5.3.4 Provide Specifications
5.3.5 Office communication
5.3.6 Display Bulletin Board
5.3.7 Provide other Forms
5.4 Safety
5.4.1 Create Safety Policy
5.4.2 Create Safety Presentation
5.4.3 Execute Safety Meeting
5.4.4 Create safety Report
5.4.5 Evaluate effectiveness of safety policy
5.4.4 Review Safety Policy
5.4.5 Develop Safety Program
5.4.6 Insure safety program is being followed
5.4.7 Discipline workers acting against safety policy
5.4.8 Report unsafe/ unusual site conditions
5.4.10 Generate Accident Report forms (send to PM)
5.4.11 Sending Forms
Home Office
Site
Consultants' Input
Managers' Input
Safety Officer Input
Safety Inspection
Changes to safety policy
Initiate/Schedule Safety Meeting
Safety Presentation
5.4.1 Create Safety Policy
5.4.2 Create Safety Presentation
5.4.3 Execute Safety Meeting
5.4.4 Create Safety Report
5.4.5 Evaluate effectiveness of safety policy
Safety policy
Safety Reports
Safety Presentation
Cloud Storage Service (ex. GoogleDrive, OneDrive, DropBox)
= Receiver
= Source
= Process
= File
= Data Flow

A-8


5.4 Safety
5.4.15 Managing Forms
5.4.16 Check In Visitors
5.4.18 Notifying PM of injuries
5.4.19 Serious Injuries – Insure cause for are conditions recorded
5.4.20 Serious injuries – Gather witnesses
5.5 Materials
5.5.1 Monitor Deliver Schedule
5.5.2 Monitor Storage
5.5.3 Surveillance
5.6 Shop Drawings
5.6.1 Review Shop Drawings
5.7 Field Variances
5.7.1 Fill out Telephone Conversation Form
5.8 Photo Records
5.8.1 Photo/Record Change Orders
5.8.2 Photo/Record Monthly Progress
5.8.3 Photo/Record Job Problems and Solutions
5.9 Daily Progress Report
5.9.1 Report Weather
5.9.2 Report Personnel
5.9.3 Report Equipment log (5.3.2)
5.9.3 Report Remarks/ Discussed Problems
5.9.4 Report Visitors (5.4.16)
5.9.5 Report Work Completed
5.9.6 Report Work in Progress (5.8.2)
5.9.7 Phone Conversation List (5.7.1)
5.10 Staff Meeting
5.10.1 Initiate Staff Meetings
5.10.2 Conducting Staff Meetings
5.10.3 Employee Input
5.10.4 Employee Attendance
5.11 Sub Meetings
5.11.1 Initiate Subcontractor Meetings
5.11.2 Conducting Subcontractor Meetings
5.12 Request For Check(s)
5.12.1 Request out of pocket expenses (send CPD)
5.12.2 Request for payment (Send to CPD)

A-9


5.13 Submission of Drawings from field
5.13.1 Request for Payment Application (5.12.2)
5.13.2 Notifying Subs of Cut-off Dates
5.13.3 Request for other forms
5.13.4 Generate Checklist
5.13.5 Verify Work in Place
5.13.6 Submit payment certificate (5.12.2)
5.13.7 Post checklist to bulletin (5.20)
5.13.8 Invoices from supplier
5.13.9 Review "Invoice Package" (VPO)
5.14 Field Records
8.14 Filling Information
5.15 Petty Cash Fund
8.15 Edit/Send Petty Cash Declaration
5.16 Budgets and Schedules
8.16.1 Review Scope of Work
8.16.2 Review Purchase Orders
8.16.3 Review Cost
8.16.4 Review Change Orders
5.17 Telephone Usage
8.17 Handle company business
5.18 Transferring Project to another Superintendent
8.18 Insure "As It Is" policy
5.19 Site Security
8.19.1 Visitor Sign In
8.19.2 Monitor Site
8.19.3 Directing Traffic
5.20 Bulletin Board
5.20 Post Items to Bulletin Board (5.3.6)

A-10

WBS	Activity	Conventional Approaches	Feasibile?	Google+ Approaches (Funtions)
5.1.1.1 Schedule Site Activities	give/receive managers' input	meetings, email discussion	Yes	video chatting, sharing text, user commenting, instant messaging
	give/receive superintendents' input		Yes	
	create 8 week program	spreadsheet, scheduling software	Yes	creating events
	create weekly program		Yes	
	filing documents	via cloud server (ex. Dropbox), local drive (ex. flash drive, harddrive)	Yes	sharing links within a community
5.1.1.2 Site Supervision	evaluate subcontractors progress	Observing work that has been set in place	Yes	video chatting, sharing images, sharing video
	collect 8 week program	receive file via email, printed copy	Yes	accessing shared events
	collect weekly program		Yes	
5.1.1.3 Write Daily Report	create daily report file	generate using a document editor (ex. Microsoft Word)	No	n/a
	filing documents	via cloud server (ex. Dropbox), local drive (ex. flash drive, harddrive)	Yes	sharing links
5.4.1 Create Safety Policy	give/receive managers' input	meetings, email discussion	Yes	video chat, share text, user commenting, instant messaging
	give/receive safety officers' input		Yes	
	create safety policy document	generate using a document editor (ex. Microsoft Word)	No	n/a
5.4.2 Create Safety Presentation	collect safety policy document	receive file via email, printed copy	Yes	accessing shared links
	collect safety report document		Yes	
	create safety presentation document	generate using slide show presentation program (ex. Microsoft Powerpoint)	Yes	sharing text, photos, links, video, events and or polls on to any community bulletin stream
5.4.3 Execute Safety Meeting	collect safety presentation document	receive file via email, printed copy	Yes	accessing shared links
	initiate safety meeting	notify site personnel via bulletin board, conversation, schedule	Yes	sharing news to google+ members
	give safety presentation	using sllide show presentation program	Yes	using bulletin streams
5.4.4 Create Safey Report	give/receive managers' input	meetings, email discussion	Yes	video chat, share text, user commenting, instant messaging
	give/receive superintendents' input		Yes	
	create safety report document	generate using a document editor (ex. Microsoft Word)	No	n/a
5.4.5 Evaluate Effectiveness of Safety Policy	collect safety policy document	receive file via email, printed copy	Yes	accessing shared links
	safety inspection	Observing site personnel, equipment, and material as work is in progress	Yes	video chatting, sharing images, sharing video
	Edit changes to safety policy document	edit using a document editor (ex. Microsoft Word)	No	n/a